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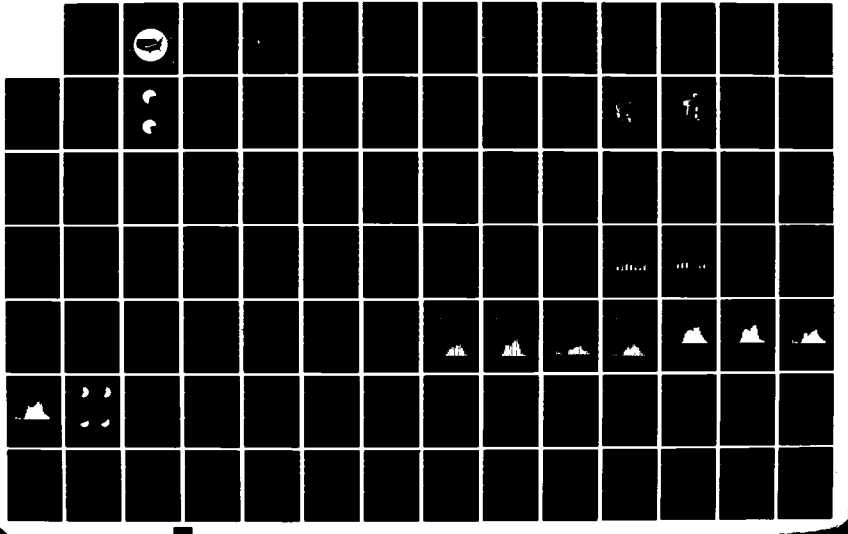

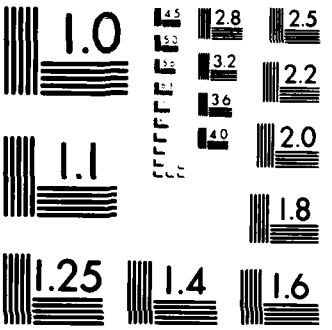

U.S. Department of Transportation
Federal Aviation Administration

(12)

NATIONAL AIRSPACE REVIEW

AIRPORT RADAR SERVICE AREA OPERATIONAL CONFIRMATION REPORT

By
Engineering & Economics Research Inc.

For
Special Projects Staff, AAT-30
Report No. DOT/FAA/AT-84/2

OCTOBER 1984

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Prepared for the
Federal Aviation Administration
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NATIONAL AIRSPACE REVIEW

AIRPORT RADAR SERVICE AREA (ARSA) OPERATIONAL CONFIRMATION REPORT

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Federal Aviation Administration
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16. Abstract

The Federal Aviation Administration conducted a year long operational confirmation of the Airport Radar Service Area (ARSA), a new concept in terminal airspace design and services recommended by NAR Task Group 1-2.2, in an attempt to standardize the designation of controlled airspace services, rules, and procedures within which terminal radar traffic control is provided. The objective of the operational confirmation was to assess the acceptability of the ARSA concept at two lead sites, Port Columbus International Airport, Columbus, Ohio, and Robert Mueller Municipal Airport, Austin, Texas.

This report presents the operational confirmation analysis of ARSA to determine its acceptance by users. Data collection and analysis effort was geared towards two specific types: (1) opinion survey of local pilots, controller/staff, and supervisor/management at each of the facilities and (2) lead site traffic activity profiles.

Based on the analysis results, and the ARSA operational confirmation criteria, it is concluded that ARSA has been confirmed at Columbus, Ohio and Austin, Texas.

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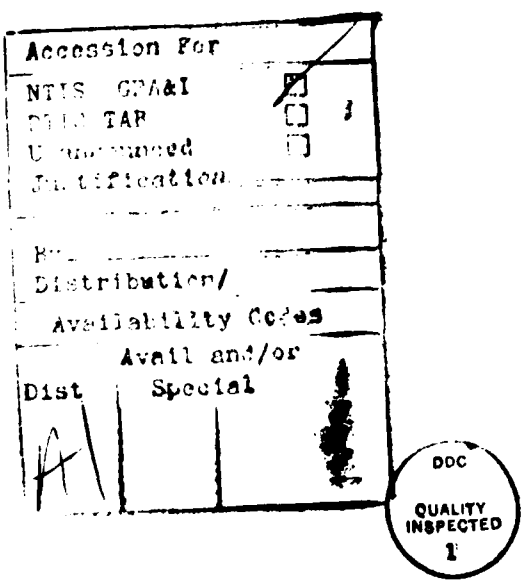

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EXECUTIVE SUMMARY

The Federal Aviation Administration (FAA) has been conducting a year long operational confirmation of the Airport Radar Service Area (ARSA), a new concept in terminal airspace design beginning December 22, 1983, for Austin, Texas and January 19, 1984 for Columbus, Ohio. This is an attempt to standardize the designation of controlled airspace services, rules and procedures within which terminal radar traffic control is provided. The two-way radio is the only equipment required of pilots to operate in ARSA airspace core. The mandatory two-way communications requirement and ATC's arrival sequencing services help to reduce the amount of unknown traffic and enhance accountability needed to afford the requisite protection in terminal area airspace. The objective of the operational confirmation was to assess the acceptability of the ARSA concept at the two sites. The FAA has current plans for an eventual conversion of 118 TRSA terminals at Level III, IV, and V facilities. The FAA will also consider an additional 18 Level II sites to validate their candidacy for conversion to ARSA's.

This report presents the operational confirmation analysis of ARSA to determine its acceptance by users. Parameters such as perceived safety, understanding of the ARSA concept, user's attitude and reaction towards participating in ARSA, perceived delays, and controller activity level effects have been evaluated.

This study has been designed with a primary focus on general aviation (GA) operators, their opinions as well as level of traffic activity, since the two-way radio communication requirement mostly affects this group. The data collection and analysis effort was geared towards two specific types: (1) opinion survey of local pilots, controller/staff, and supervisor/management at each of the facilities, and (2) lead site traffic activity profile.

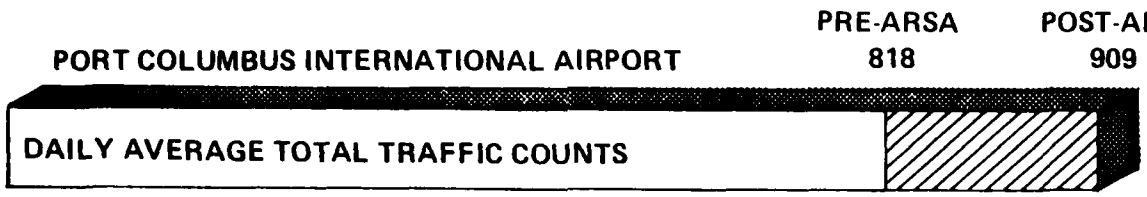
The survey data consisted of a stratified random sample of pilots during the post-ARSA period. Available physical data consisted of hourly traffic counts, surface weather observations, facility records, FSS flight plans and flight progress strips for 7 pre-ARSA days and 31 post-ARSA days.

For the physical data, seven day samples (Monday through Sunday) of TRACON traffic counts were analyzed. The typical days operations in the pre-ARSA period were compared to the corresponding operations in the post-ARSA period on a hour to hour basis and under similar weather conditions at each lead site. The daily average traffic counts for the two sites are:

	PRE ARSA	POST ARSA
• Robert Mueller Municipal Airport	759	842
• Port Columbus International Airport	818	909

Physical data analysis results revealed that there have not been any noticeable shifts in hourly traffic activity and peaking characteristics at both lead sites, and that there have been no significant changes in the traffic mix (AC, AT, GA and MIL) being worked by the controllers. However, there has been an increase in traffic counts at each of the facilities. Figure A illustrates the summary results of traffic activity analysis on a daily average basis.

PHYSICAL DATA ANALYSIS RESULTS
EFFECTS ON TRAFFIC ACTIVITY



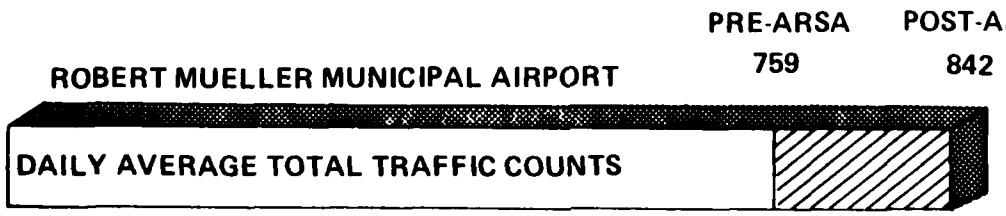


Figure A. Overall Average Daily Increase in Traffic Counts

At Robert Mueller Municipal Airport, daily average VFR counts have increased by 41% while IFR counts have decreased by 3%. At Port Columbus International Airport, daily average VFR counts have increased by 17% and IFR counts have increased by 9%. These IFR/VFR counts changes are primarily due to the increased participation within ARSA. This conclusion is supported by controllers opinion survey results. The relatively higher increases in VFR traffic support the expected effects of ARSA due to its mandatory participation requirements.

Based on the opinion survey results, no adverse effects on safety or delays have been encountered that are attributable to the additional traffic worked by the controller during the busy hour conditions.

Due to the OMB disapproval of total population survey, the local pilot survey was based on a statistical random sample of 1150 pilots which make up 12% of all the registered pilots in the lead site areas. For the controller/staff and supervisor/management survey, all the facility personnel were contacted. The opinion surveys were conducted through mailed questionnaires and telephone interviews during the months of June, July and August of 1984. Responses were received from 569 pilots, 56 controller/staff and 13 management/supervisors. The response rates were 51% 75% and 87% respectively.

Pilot survey data analysis revealed the following:

(1) About 75% of the respondents surveyed understand the services available within the ARSA.

(2) Sixty-nine percent of the respondents learned about the services provided in ARSA Through FAA public meetings, FAA publications and Letters to Airmen.

(3) The extent and level of ATC services provided to the airspace users have been consistent as reported by more than 70% of the respondents.

(4) A majority of the respondents (56%) feel that implementation of ARSA has caused no change to their flying. About 10% feel that they have either altered their route of flight, their altitude, or both to avoid ARSA.

(5) Although some pilots expressed concern over the congestion on ATC radio frequencies and the requirements to use higher radio frequencies, 76% feel that two-way radio communication requirements are acceptable.

(6) About 67% of the respondents agree with the shape, dimensions and depiction of ARSA on FAA charts. About 9% of the respondents did not agree with the ARSA frequency information depiction on FAA charts.

(7) Of the pilot respondents, 62% have expressed a positive reaction to participating in ARSA. Additionally, more than 70% of GA pilots who are frequent flyers have shown positive reaction to participating in ARSA.

(8) Seventy percent (70%) of the pilots feel that safety is enhanced by participation of all aircraft within ARSA.

As graphically depicted in Figures B and C, these findings relate to the overall assessment of pilot opinion which reveals a significant pilot perception of safety enhancement and a strong positive attitude towards participation in ARSA.

Overall assessment of controllers' opinion reveals that controllers feel that safety has been enhanced, delays have not resulted, pilot participation has increased and pilots have a positive reaction towards ARSA along with good understanding of the airspace structure. However, 71% of the respondents feel that they have experienced increases in workload.

Supervisors/managers have a very positive reaction towards the implementation of ARSA at their facilities. The majority of them feel that there have been fewer complaints from airspace users since the implementation of ARSA, and the administration of the facility has been more or less the same. Ninety-two percent of the respondents support continuation of ARSA operations at their facilities.

ARSA confirmation follows from the fact that there have been no adverse effects that can be attributed to the implementation of the Airport Radar Service Area at both lead sites. The ARSA acceptance factors that have been considered in making this determination are:

- perceived increase in safety;
- increased participation by pilots (local, itinerant and military);
- understanding of ARSA concept by the users and consistency of services provided;
- no noticeable increase in delays;
- no adverse impact on pilot's flying pattern;
- fewer complaints by airspace users;
- ease in administering ATC facilities;
- positive effect on traffic activity.

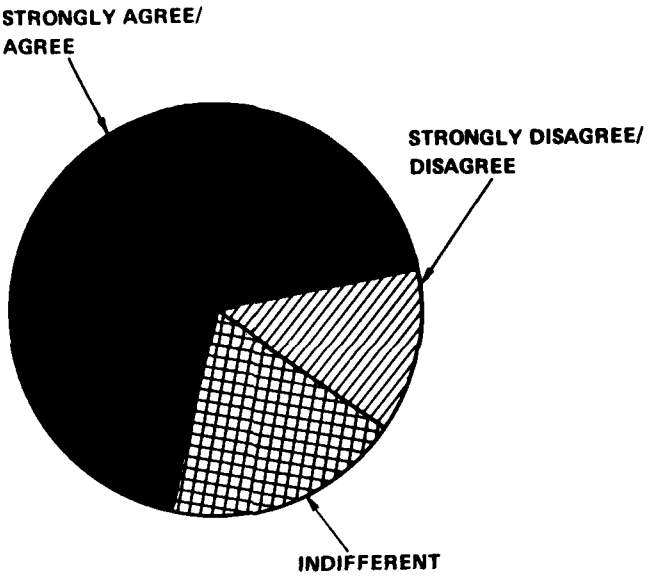


Figure B. Pilot Survey Response on Overall Acceptance of ARSA

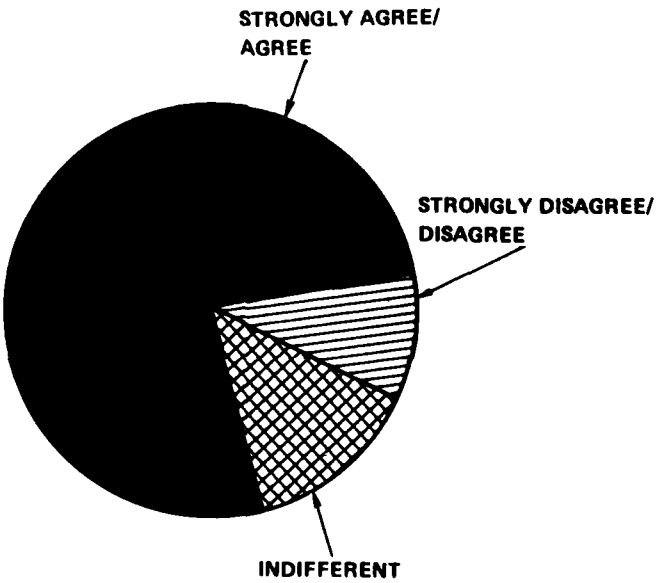


Figure C. Pilot Survey Response on Perceived Safety of ARSA

1.0 INTRODUCTION

An Airport Radar Service Area (ARSA), also referred to as Model B Airspace, is currently replacing the familiar Terminal Radar Service Area (TRSA) at the Robert Mueller Municipal Airport, Austin, Texas and the Port Columbus International Airport, Columbus, Ohio. The Federal Aviation Administration (FAA) has been conducting a year long operational confirmation of this new concept in terminal airspace design and services. This program began on December 22, 1983, for Austin and January 19, 1984, for Columbus.

This report presents the operational confirmation analysis of the ARSA program at the two lead sites. In particular, the report contains results of analysis of pilot, controller and facility supervisory/management staff opinion survey responses, and limited physical data consisting of traffic activity at both sites. The primary objective of the analysis was to compare pre and post-ARSA traffic activity to estimate the effects of ARSA and to evaluate survey responses to estimate pilot, controller and facility management acceptance of the ARSA concept.

The Airport Radar Service Area rules followed recommendations of the National Airspace Review (NAR), Task Group 1-2.2. The Task Group was made up of members from the FAA, the Department of Defense (DOD), and the user community. The mandate assigned to the Task Group was to review the TRSA concept to determine the validity of the served airspace in meeting user requirements considering safety, efficiency, the air traffic control environment and the regulatory or non-regulatory concepts.

The Task Group identified a number of problems with the TRSA program which they felt should be corrected. The task group noted that, because there are different levels of service offered within the TRSA, users are not always sure of what they are getting in terms of service. In addition, users are not always sure of what restrictions/privileges exist, or how to cope with them. There is a feeling shared among users that TRSA's are often poorly defined, generally dissimilar in dimensions, and encompass more area than is necessary or desirable. Other users believe that the voluntary nature of the TRSA does not adequately address the problems associated with nonparticipating aircraft operating close to the airport and associated approach and departure courses. There is strong advocacy among user organizations that terminal radar facilities should provide all pilots with the same service, in the same way, and to the extent feasible, with standard size airspace designations.

The proposed ARSA concept is an attempt to standardize the services, rules, procedures and the designation of controlled airspace within which terminal radar traffic control is provided. The task group made 8 recommendations[1]. Seven of the recommendations are directly relevant to ARSA operational confirmation which are given in Appendix A. The ARSA airspace structure and the services offered are shown in Figure 1.

Under ARSA the extent of services provided will be reduced in terms of separation between IFR and VFR. However, intra-facility coordination and communications between pilots and controllers or traffic advisories may increase.

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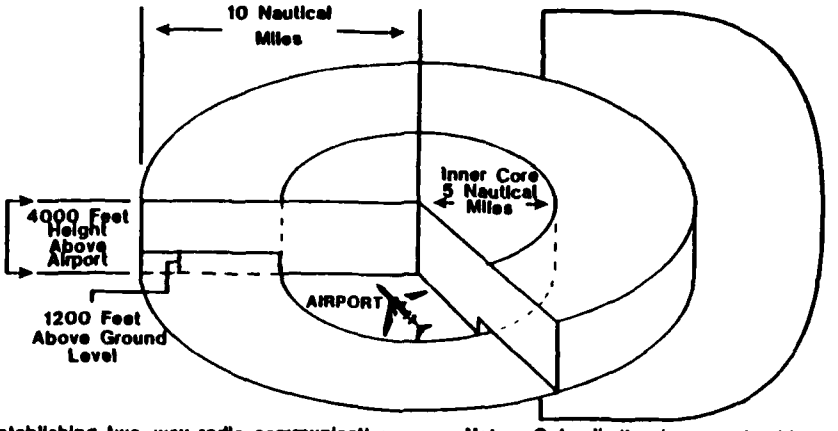
[1] U.S. Department of Transportation, Federal Aviation Administration, Terminal Airspace Task Group 1-2.2, Terminal Radar Service Area Staff Study, December 1982.



Services upon establishing two-way radio communication and radar contact:
Sequencing Arrivals
IFR/IFR Standard Separation
IFR/VFR Traffic Advisories and Conflict Resolution
VFR/VFR Traffic Advisories

Note: Outer limits airspace should coincide with each facility's designated airspace. Outer limits airspace indicates Area of Radar/Radio Coverage.

IFR: Instrument Flight Rules
VFR: Visual Flight Rules

Figure 1. Airport Radar Service Area (ARSA)

To determine the benefits and costs of ARSA, the FAA conducted a detailed regulatory evaluation[2]. The FAA determined that the provisions of this special federal aviation regulation (SFAR) provide cost savings to society in general and certain general aviation (GA) operators in particular that outweigh the additional costs imposed on those operators. The three expected primary benefits are (1) a reduction in mid air collision (MAC) occurrences, (2) operating costs savings due to reduced separation minimums and, (3) airspace simplicity. The simplicity of the ARSA airspace structure and the standardized services within ARSA should be easier for GA operators to understand and operate in.

The ARSA mandatory two-way communications requirement and ATC's arrival sequencing services provide a mechanism for reducing the amount of unknown traffic and the accountability needed to afford the requisite protection closer to the airport. The provisions of this SFAR impose new costs on certain GA operators in terms of additional delays that may be incurred because of the possibility of receiving ATC instructions or clearances which would delay access to the ARSA. The overall ARSA benefit-cost ratio[3] is estimated to be 1.92 to 1.00.

The operational details of the program were contained in the Special Federal Aviation Regulation (SFAR) No. 45 published in the October 28, 1983 Federal Register and discussed during the lead site working group meeting held on July 25-28, 1983. During these discussions, the facility directives, letters of agreement, standard facility training package and the scope and extent of user education were finalized. The FAA conducted user briefings for each of the ARSA sites and other local areas affected by the installation of ARSA.

Appendix B gives the details of locations here the user briefings were held and the number of participants. User briefing packages include SFAR, handouts depicting ARSA, communication frequencies and operating requirements, letters to Airmen and visuals depicting the specific airspace, facility

[2]U.S. Department of Transportation, Federal Aviation Administration Regulatory Evaluation of Notice of Proposed Rule Making to implement an Airport Radar Service Area at Columbus, Ohio and Austin, Texas, Office of Aviation Policy and Plans, Regulatory Analysis Branch; July 13, 1983.

[3]U.S. Department of Transportation, Federal Aviation Administration, National Airspace Review, Benefits and Costs, Report No. DOT/FAA/AT-84/1, May 1984.

directives, standard operating procedures, and NAR Task Group 1-2.2 Terminal Radar Service Area Staff Study. These packages were available to users at briefings or upon request at both lead sites. Air traffic controllers were informed about ARSA operating procedures and regulations through training and appropriate information packages. The educational activities were directed mainly toward the two confirmation sites.

The lead site working group was reconvened during August 13-16, 1984 to review the data collected from the lead sites during various users briefings and all other applicable sources and to submit recommendations concerning the national applicability of ARSA.

EER's role in the ARSA operational confirmation program included: providing meeting support at the lead site working group meetings and ARSA briefing sessions; documenting meeting results; coordinating publication of ARSA information for dissemination to the flying public; preparing pilot, controller/staff and supervisor/management staff questionnaires with the cooperation of the FAA (AAT-200, AAT-300, APO-220); preparing justification statement of the pilot questionnaire for OMB approval; identifying data sources and developing methods for determining the effects of ARSA on airport operations; developing and documenting processing methods to be applied to data obtained from opinion surveys and lead site physical observations and providing additional support as directed and requested by the FAA. EER's data collection and analysis effort was focused on two specific field related data sets, namely, lead site traffic activity profile on an hourly basis in the Pre and Post ARSA periods and opinion surveys of local pilots, controllers/staff and supervisors/ management personnel.

The operational confirmation sought to evaluate the ARSA concept in terms of the provision of a clear definition of terminal airspace, simplification and accountability as contributors to safety, uniformity of services, and degree of user acceptance.

This study has been designed focusing on general aviation operators (their opinions as well as traffic activity) since the two-way radio communication requirement mostly affects this group.

Because of the ARSA implementation schedule and the OMB disapproval of the total population survey, the user survey effort concentrated on a statistical sample of local pilots during the Post-ARSA period for both lead sites. The available physical data consisted of 7-day pre-ARSA and 31-day post-ARSA data sets on hourly traffic counts, surface weather observations, facility records, FSS flight plans and flight progress strips.

An integrated approach for physical data analysis and opinion survey data analysis was adopted for assessing the overall impact of ARSA. Parameters such as perceived safety, understanding of ARSA concept, user's attitude and reaction towards participating in ARSA, perceived delays and controller workload effects.

Section 2 deals with the selection of the two lead sites, prevailing traffic conditions, details of runway configurations, primary airport airspace, weather profile and review of the specific site-related Aviation Safety and Reporting System (ASRS) reports. A brief summary of the ARSA user briefings and lead site working group meetings is also presented.

The complete analysis in Section 3 discusses objectives, methodology and results. Section 4 highlights the confirmation criteria and results of the operational confirmation of the ARSA concept at the two sites. The analysis presented in this report should assist the FAA in confirming the ARSA.

2.0 THE TWO LEAD SITES

As stated in the introduction section, NAR Task Group 1-2.2 recommended that the Airport Radar Service Area (ARSA), a new concept in terminal airspace design, be reviewed and operationally confirmed as a possible replacement for Terminal Radar Service Areas (TRSA's). The purpose of this section of the report is to define the selection criteria for choosing Robert Mueller Municiple Airport, Austin, Texas, and Port Columbus International Airport, Columbus, Ohio.

2.1 SELECTION CRITERIA

The two lead sites for the ARSA Operational Confirmation were selected using the following criteria:

- One site should be a level III facility and one should be a level IV facility; one site should be near a military base.
- Both sites should have the next scheduled charting revision date on or about January 1, 1984.
- One site should have a traffic mix with a large component of general aviation.
- One site should have a traffic mix with a large component of military traffic.
- The site should have the requisite facility resources.
- One site should be in the Southwest region because that region has a previous involvement in developing conflict resolution procedures.

Based on these criteria Robert Mueller Municipal Airport, located in Austin, Texas, and Port Columbus International Airport, located in Columbus, Ohio, were designated the Airport Radar Service Areas for the one year operational confirmation process.

2.2 THE PRIMARY AIRPORT ARSA AIRSPACE

The Austin, TX, ARSA[4] includes the airspace extending upward from the surface to and including 4,600 feet MSL within a 5 nautical mile radius of the Robert Mueller Municipal Airport; that airspace extending upward from 2,000 feet MSL to 4,600 feet MSL within a 10 nautical mile radius of Robert Mueller Municipal Airport from the 027° true bearing from the airport clockwise to the 207° true bearing from the airport, and that airspace extending upward from 2,300 feet MSL to 4,600 feet MSL within a 10 nautical mile radius of the airport from the 207° true bearing from the airport clockwise to the 027° true bearing from the airport.

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[4]U.S. Department of Transportation, Federal Aviation Administration, Special Federal Aviation Regulation, Model B Airspace (Airport Radar Service Area), Federal Register/Vol. 48, No. 210/Friday October 28, 1983/Rules and Regulations, pp. 50046.

[5]Ibid., Federal Register pp. 50046.

The Columbus, OH, ARSA[5] includes the airspace extending upward from the surface to and including 4,800 feet MSL within a 5 nautical mile radius of the Port Columbus International Airport; that airspace extending upward from 2,500 feet MSL to 4,800 feet MSL within a 10 nautical mile radius of Port Columbus International Airport from the 008° true bearing from the airport clockwise to the 127° true bearing from the airport; and that airspace extending upward from 2,200 feet MSL to 4,800 feet MSL within a 10 nautical mile radius of the airport from the 127° true bearing from the airport clockwise to the 008° true bearing from the airport.

The primary airport is the airport for which the ARSA is designated. A satellite airport is any other airport, heliport, helipad, etc., within the ARSA.

Outer Limits Area

The outer limits area airspace at both lead sites extends to the boundary of approach controls delegated airspace wherever radar/radio coverage exists. While strongly encouraged, two-way radio communications is not a VFR requirement in the outer limits area and aircraft are not restricted from entering/transiting this airspace.

Figures 2 and 3 depict the airport radar service areas and the locations of satellite/secondary airports at the Robert Mueller Municipal and Port Columbus International Airports, respectively.

2.3 RUNWAY CONFIGURATION

Robert Mueller Municipal Airport Austin, Texas

The airport has a set of Northwest/Southeast parallel runways (13R-31L/13L-31R) and a North/South runway (17-35). Runway 13R-31L is the longest of the airport runways being 7269 feet long by 150 feet wide. It has an asphalt surface. Runway 13R-31L is the primary instrument runway and has a published instrument approach which utilizes an ILS approach with published landing minimums of ceiling 200 feet, visibility 3/4 mile for runway 13R, and ceiling 200 feet, visibility 1/2 mile for runway 31L. Numerous high performance aircraft operate in the vicinity of the airport below 3500 feet. Noise abatement procedures are in effect at the airport.

Port Columbus International Airport, Columbus, Ohio

The airport has a set of East West parallel runways (10R-28L/10L-28R). In addition, there is a Northwest/Southeast runway (31-13) and a Northeast/Southwest runway (5-23). Runway 10R-28L is the longest of the airport runways being 10,701 feet long by 150 feet wide. It has an asphalt surface. Runway 10R-28L is the primary instrument runway and has a published instrument approach which utilizes an ILS approach with published landing minimums of ceiling 200 feet, visibility 1/2 mile for both runways.

Both airports are served by an operational FAA Control Tower, TRACON, FSS, and parking ramps for general aviation. See airport diagrams Figures 4 and 5 for more details.

ROBERT MUELLER MUNICIPAL AIRPORT
AUSTIN, TEXAS

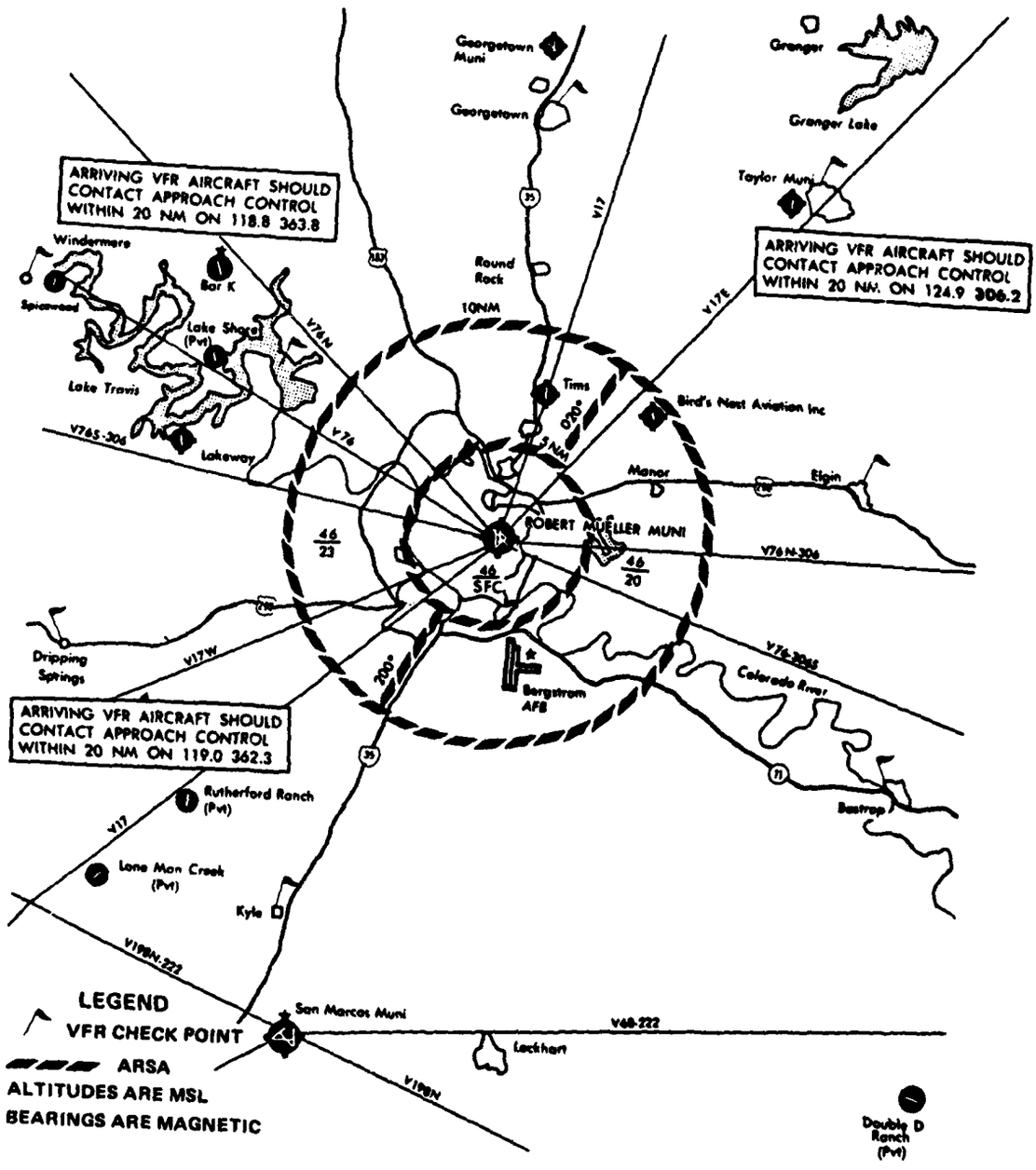

Figure 2. Austin Airport Radar Service Area (ARSA)

PORT COLUMBUS INTERNATIONAL AIRPORT
COLUMBUS, OHIO

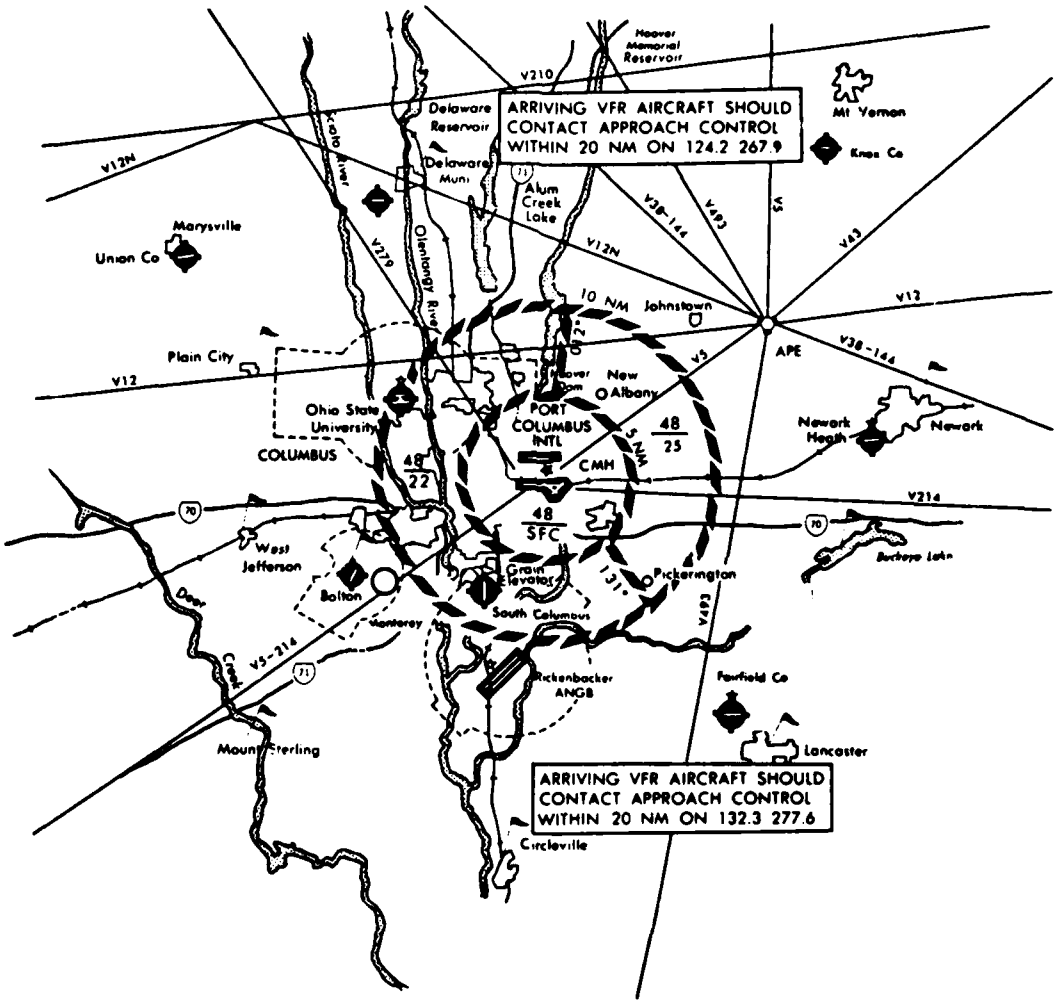

Figure 3. Columbus Airport Radar Service Area

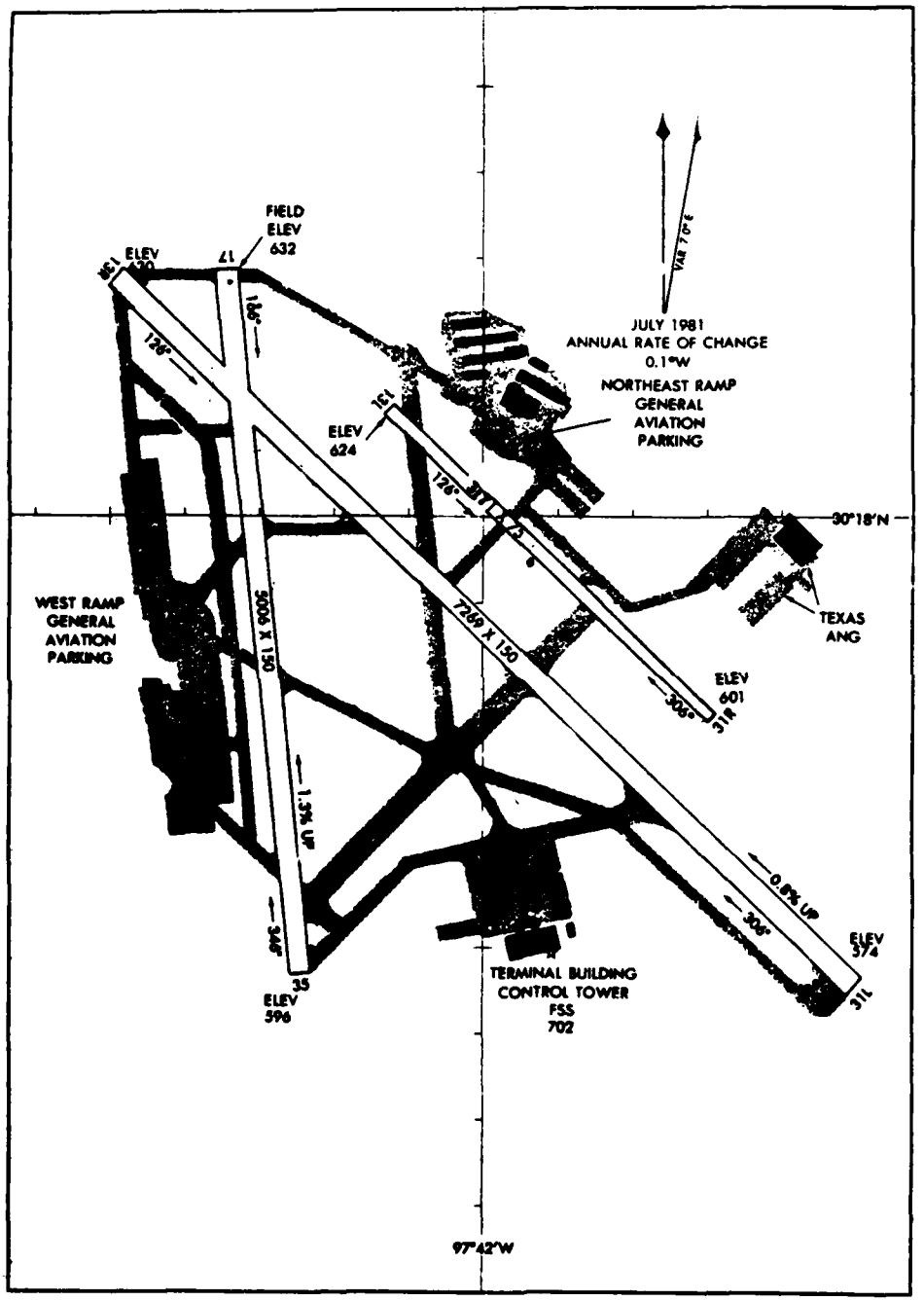

Figure 4. Robert Mueller Municipal Airport Diagram

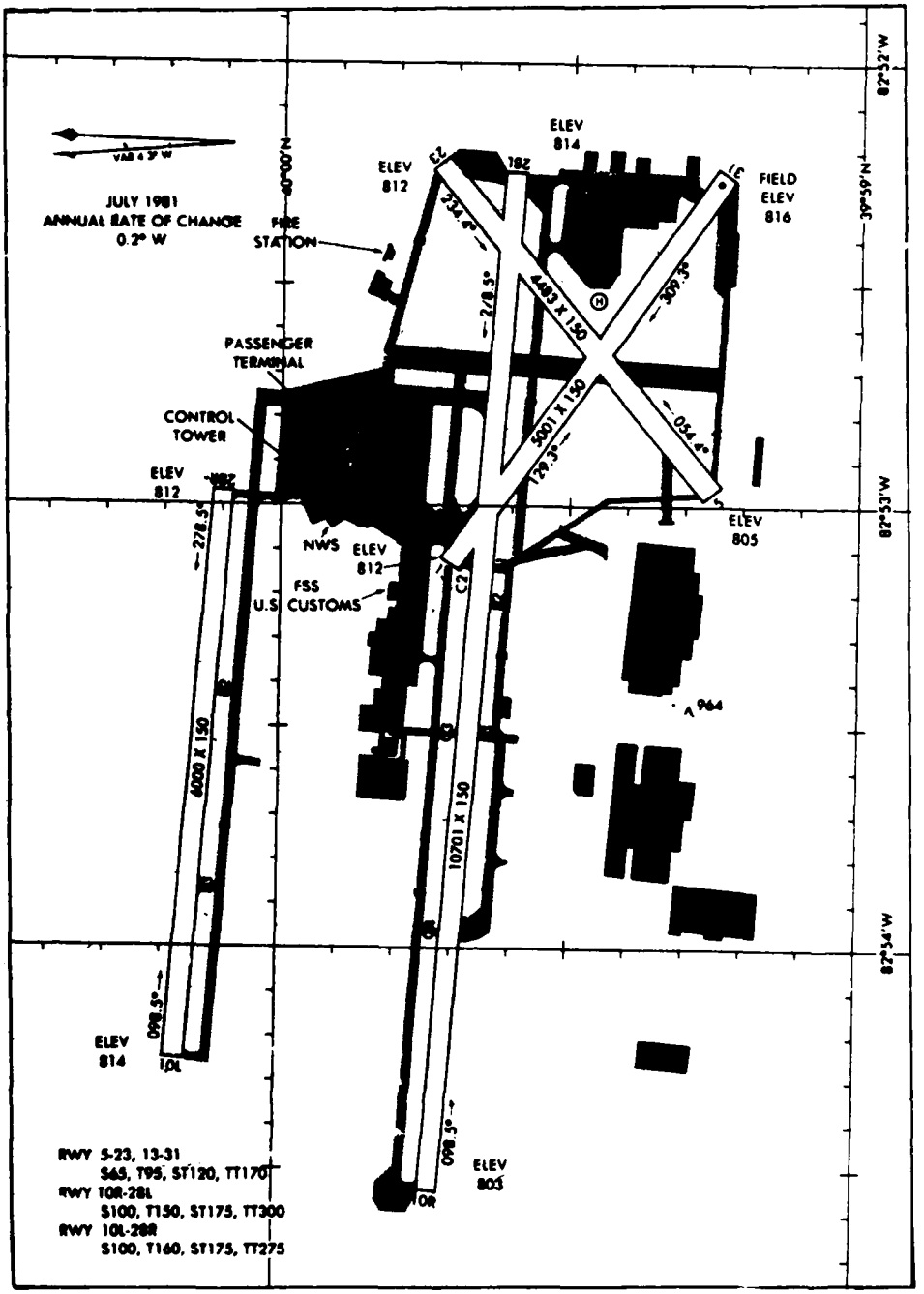

Figure 5. Port Columbus International Airport Diagram

2.4 HISTORICAL DATA BASE

The historical data base review included an in-depth analysis of annual traffic activity profiles for 1979-1983 in terms of traffic mix, GA activity, military operations, and monthly operations summaries of the two lead sites. In addition, ASRS data and NTSB reports were reviewed along with NWS Climatological Summaries. The primary purpose for reviewing these data sets was to determine whether these sites were representative, from a comparative basis, of the other TRSA sites. The data shows that Austin, Texas and Columbus, Ohio are similar in nature to approximately 104 TRSA sites.

2.4.1 Annual Traffic Activity Profile

The FAA collects facility statistical data to be used for a variety of reasons. These include forecasting, planning, facility classification, decision making, programming, new equipment and budgeting. The Airport operations count is the statistic maintained by the control tower. Basically it is the number of arrivals and departures from the airport at which the air traffic control tower is located. The instrument operations count is the statistic maintained by the terminal approach control facility.

The airport operations (Tower) and instrument operations (TRACON) of both lead sites were reviewed and analyzed for the fiscal years 1979 to 1983. Based on the total number of airport operations, the average general aviation activity, over a period of 5 years, comprise 60% of operations for the Columbus site and 68% for the Austin site.

The annual instrument operations for the last 5 years are tabulated by user categories of Air Carrier, Air Taxi, General Aviation and Military for both the sites in Table 1. The average annual instrument operations during these years is more than 150,000 for Austin and 300,000 for Columbus Sites.

The average traffic mix figures are also shown in Table 1. It is evident that general aviation is the major component of air traffic activity and that a good variation exists between Austin and Columbus sites concerning military operations. On the average, overflights comprise 21% of the total traffic worked by the terminal radar approach control for the Columbus facility and 11% for the Austin facility.

2.4.2 Facility Monthly Summaries

Daily operations count for the period January 1983 to March 1984 was reviewed for Austin and Columbus Sites to compare the traffic volumes worked by Tower and TRACON under different levels of services offered at each of the facilities. In the case of Austin, traffic counts for the earlier 12-month period (August 1980 to July 1981) when Stage III was in operation were also taken into consideration to see the comparative trends at the two lead sites.

The total monthly counts were plotted for Tower and TRACON for each of the facilities and they are shown in Figures 6 and 7. The most significant observation is that when comparing the level of facilities on the basis of traffic counts, it is important to note the type of ATC services [TRSA (Stage III), TRSA (Stage II) or ARSA], being offered and the operational counts being credited to the facility's monthly record.

Table 1: Instrument Operations[6] with FAA-Operated Traffic Control Towers, RAPCONS, and RATCFS

ROBERT MUELLER MUNICIPAL AIRPORT – AUSTIN, TEXAS

YEAR	AC	AT	GA	MIL	TOTAL
1979	35,768	8,874	51,282	41,744	137,668
1980	34,601	13,296	94,106	35,342	177,345
1981	35,938	12,425	121,021	25,433	194,817
1982	36,282	9,993	50,625	20,554	117,454
1983	41,373	10,366	63,323	31,811	146,873
Average Traffic Mix	24%	7%	49%	20%	100%

PORT COLUMBUS INTERNATIONAL AIRPORT – COLUMBUS, OHIO

YEAR	AC	AT	GA	MIL	TOTAL
1979	54,487	25,779	216,916	32,025	329,207
1980	50,598	31,927	215,405	25,780	323,710
1981	46,294	39,899	190,063	21,011	297,267
1982	50,827	57,080	144,436	17,334	269,677
1983	50,761	62,464	164,917	17,753	295,895
Average Traffic Mix	17%	14%	61%	8%	100%

It can be determined from Figure 7 that the TRSA to ARSA change for the Columbus Facility has not generated any relative change in the Tower and TRACON counts while Figure 6 reflects a change at Austin from Stage II to ARSA which reversed the volume in the reported tower and TRACON counts.

2.4.3 Brief Review of Aviation Safety Reporting System (ASRS) Reports

ASRS data for the Austin and Columbus sites during 1978-1984 was analyzed and reflects incidents generally between IFR and VFR and between VFR and VFR flight types of operations. On a national scale, 95% of the near-mid air collisions[7] occur between VFR air traffic operating outside the air traffic control system. The data for the two lead sites was obtained from the NASA Aviation Safety Reporting System Office, Mountain View, California. All the incidents reported in the data base were tabulated and analyzed as illustrated in Appendix C. The comments on the ARSA effect portion of the summary presented in Appendix C are expressed by EER Technical Staff who have

[6] U.S. Department of Transportation, Federal Aviation Administration, FAA Air Traffic Activity Reports FY 1979 to 1983.

[7] The Weekly of Business Aviation; Vol. 39; No. 6 August 6, 1984 Page 42.

ROBERT MUELLER MUNICIPAL AIRPORT
AUSTIN, TEXAS

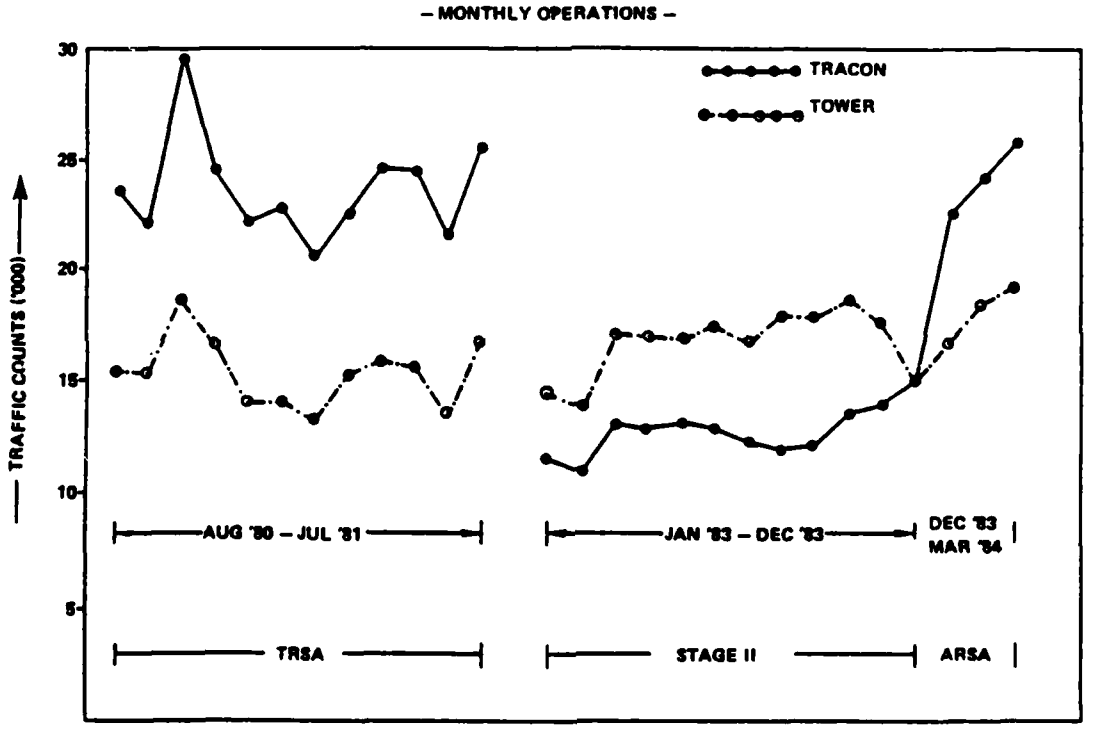

Figure 6. Comparative Traffic Counts Worked by TRACON and Tower Under Different Services – Robert Mueller Airport

PORT COLUMBUS INTERNATIONAL AIRPORT
COLUMBUS, OHIO

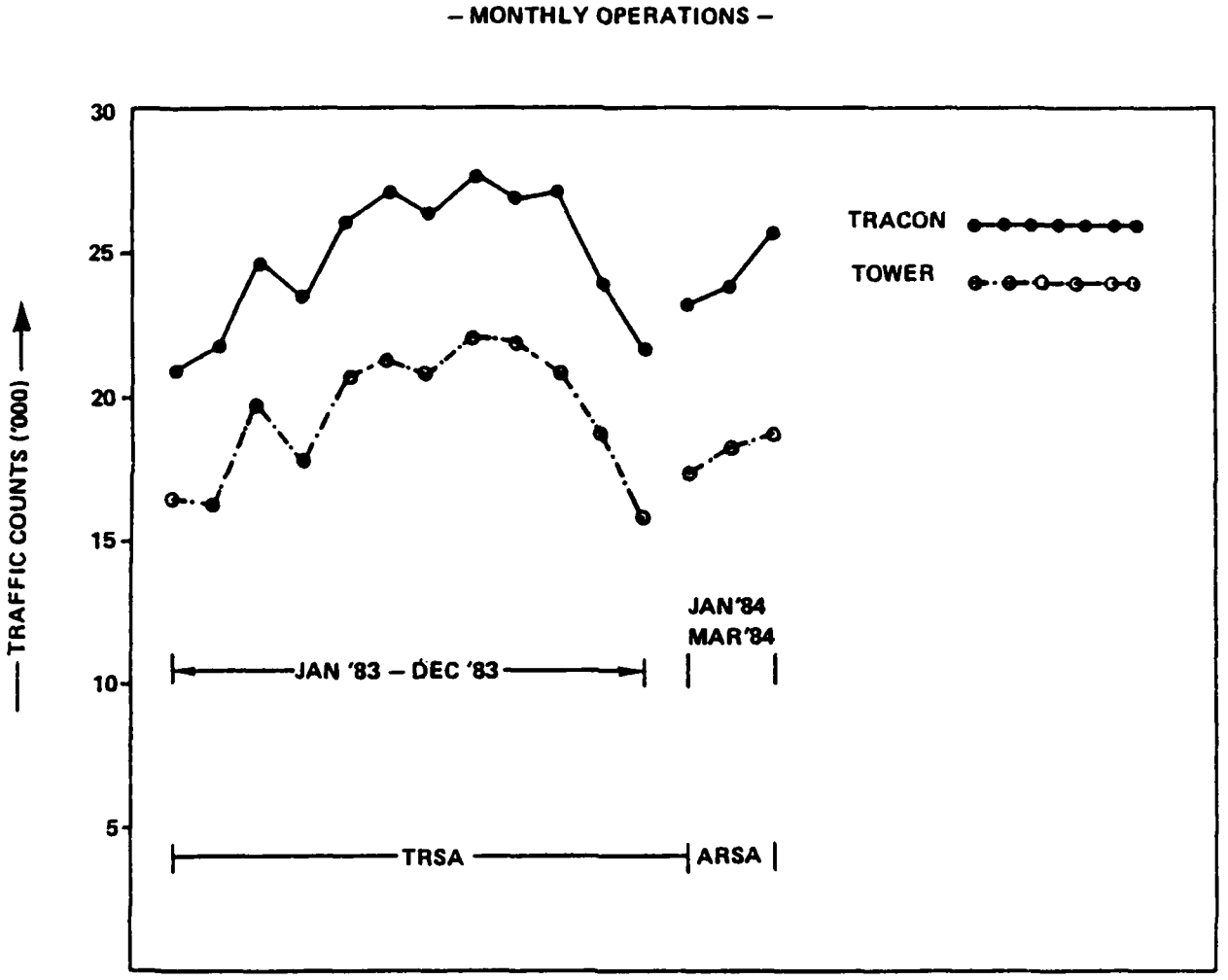

Figure 7. Comparative Traffic Counts Worked by TRACON and Tower Under Different Services – Port Columbus International Airport

the requisite ATC experience. The comments made are of a general nature and take into consideration only the nature of the various incidents and whether or not services offered under ARSA and mandatory two-way radio communication requirement may have been helpful in averting the situation.

The results show that 38% of the incidents out of a total of 29 analyzed for Austin and 33% of the incidents out of a total of 15 analyzed for Columbus may not have occurred or the probability of their occurrence would have been greatly reduced, had ARSA been in effect.

2.4.4 Climatological Summary[8]

Austin, Texas

The climate of Austin is humid subtropical with hot summers. Winters are mild, with below freezing temperatures occurring on an average of less than 25 days each year. Rather strong northerly winds, accompanied by sharp drops in temperature, occasionally occur during the winter months in connection with cold fronts, but cold spells are usually of short duration, rarely lasting more than two days. Daytime temperatures in summer are hot, but summer nights are usually pleasant with average daily minima in the low seventies.

Precipitation is fairly evenly distributed throughout the year, with heaviest amounts occuring in late spring. A secondary rainfall peak occurs in September. Precipitation from April through September usually results from thunder showers, with fairly large amounts falling within short periods of time. While thunderstorms and heavy rains have occurred in all months of the year, most of the winter precipitation occurs as light rain. Snow is insignificant as a source of moisture, and usually melts as rapidly as it falls. The city may experience several seasons in succession with no measurable snowfalls.

Prevailing winds are southerly throughout the year. Northerly winds accompanying the colder airmasses in winter soon shift to southerly as these air masses move out over the Gulf of Mexico.

The average length of the warm season (freeze-free period) is 270 days. Destructive winds and damaging hailstorms are infrequent. On rare occasions, dissipating tropical storms affect the city with strong winds and heavy rains.

Columbus, Ohio

Columbus is located in the area of changeable weather. Air masses from central and northwest Canada frequently invade this region. The tropical gulf masses often reach central Ohio during the summer and to a much lesser extent in the fall and winter. There are also occasional weather changes brought about by cool outbreaks from the Hudson Bay region of Canada, especially during the spring months. At infrequent intervals the general circulation will bring showers or snow to Columbus from the Atlantic. Although Columbus does not have a "wet" or "dry" season as such, the month of October has a higher frequency of light rainfall than any other month and comes close to providing a normal dry period.

[8]Department of Commerce, National Oceanic and Atmospheric Administration, Local Climatological Data, Annual Summary with Comparative Data; 1982.

The narrow valleys associated with the streams flowing through the city supply the only variation in the micro-climate of the area. The records show a high frequency of calm or very low winds speeds during the late evening and early morning hours, from June through September. The rolling landscape is conducive to air drainage and from the Weather Service location at the airport the air drainage is toward the northeast with wind direction indicated as southeast. Air drainage takes place at speeds generally 4 m.p.h. or less and frequently provides the only perceptible breeze during the night.

2.5 ARSA USER BRIEFINGS

EER supported a selected set of user briefings both at Austin and Columbus. The meetings were attended by the ATCT personnel, representatives from FAA Headquarters, and pilots. There were many issues raised during these meetings especially questions relating to the size and shape of ARSA, additional delays prior to departures, effect on ultralight operations and parachute jumping procedures, frequency boundaries and listing on sectional charts, SVFR operations, overlapping of control zones, altitude assignments between two VFR aircraft, outer area services and user requirements to enter ARSA, reduction in separation standards, extra workload on controllers and the concern that two test sites may be too limited for ARSA confirmation nationally. These queries were answered by the acting facility chiefs of the two lead sites. The primary objective of these briefings was to stimulate awareness of ARSA among the different categories of users.

In general, most participants felt that there will not be any significant impact on their existing operations. They also felt that standardized approach procedures should be a great improvement and that if ARSA succeeds, it will correct some of the existing problems with unknown VFR traffic in and around terminal areas.

2.6 LEAD SITE WORKING GROUP MEETINGS

There were two lead site working group meetings held in relation to the confirmation of ARSA. The first, convened July 25-28, 1983, discussed the development of facility directives, provided inputs to cartographic requirements, developed Letters of Agreement, developed standard facility training packages, and determined the scope and extent of user education. The second, convened August 13-16, 1984 reviewed the data collected from the two lead sites, and other sources, and submitted recommendations as to the national applicability of ARSA.

At the second meeting, APO-120 presented the lead site working group with an overview of their draft analysis of pre and post-ARSA physical data. Several recommendations[9] were generated by the participants of this meeting and are submitted to the FAA by EER as Airport Radar Service Area (ARSA) Lead Site Working Group Meeting Report (draft), dated September 5, 1984. The concluding statement of this group was:

> "It was the unanimous opinion of the lead site working group that the ARSA program as originally implemented should be modified in accordance with the recommendations made in the meeting. With such modifications incorporated, it is an airspace, procedural and operating environment that represents a safe, efficient and standardized alternative to the TRSA program."

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[9] Airport Radar Service Area (ARSA); Lead Site Working Group Meeting Report (Draft), September 5, 1984.

3.0 ARSA EVALUATION

3.1 OBJECTIVES

The approach to the operational confirmation evaluation of the Airport Radar Service Area concept was designed with the following objectives:

1. Acceptance by the Users
    - Understanding of the concept and services provided in the ARSA core/outer limits area generated by the simplicity of its shape, dimensions, and consistency of services.
    - Perceived safety
    - Perceived impact on flying patterns
    - Positive reaction towards participation in the ARSA
2. Controllers/Management acceptance
    - Perceived delays
    - Perceived safety
    - Controller activity levels
    - Ease of administration
3. Effects on Traffic Activity

3.2 DATA FORMATS/TYPES

Survey Data: Three distinct opinion surveys were conducted for pilots, controllers/staff and facility supervisors/management, using questionnaires which are described in Appendix D. The pilot questionnaire mainly seeks information on pilot's certificates and ratings, types of aircraft flown, flight type, avionics equipment utilized, primary airport/aircraft base, number of flights, and opinion questions relating to ARSA structure, understanding, safety and their reaction towards participating in ARSA. The controller/staff questionnaire deals with experience levels, perceived safety, delays, pilots participation, ATC procedures, communication times, and workload. The supervisor/management questionnaire focuses on administration of the ATC facility, complaints by the user groups, safety, level of intrafacility coordination and viewpoints on the national applicability of ARSA.

Survey questionnaire responses were used to assess user, controller and management attitude and reaction towards implementation of ARSA at the two lead sites.

Physical Data: The table below lists the pre- and post-ARSA physical data that was provided to EER and the time period which the data covered.

	AUSTIN		COLUMBUS	
	Pre	Post	Pre	Post
	11/16/83-11/22/83	3/1/84-3/31/84	11/8/83-11/14/83	3/15/84-4/15/84
1. Hourly Tower Traffic Counts (Airport Operations)	x	–	–	–
2. Hourly TRACON Traffic Counts (Instrument Operations)	x	x	x	x
3. Flight Progress Strips	x	x	x	x
4. FSS Flight Plans (FAA Form 7233-1)	x	x	x	x
5. Facility Operations Record (FAA Form 7230-4)	x	x	x	x
6. Surface Weather Observations (NWS Form 1-10A)	x	x	x	x

It is evident from the pre- and post-ARSA data sets that the physical data anlaysis was based primarily on the comparison of pre- and post-ARSA hourly TRACON traffic counts because hourly tower traffic counts were not available in the post-ARSA period. However, tower flight progress strips were made available but the number of strips did not correlate with the tower counts as reported on pre-ARSA logs in the case of the Austin facility. Most of the Stage II (pre-ARSA) and ARSA strips marked "A" (post-ARSA) did not have times on them, so there appears to be no way to verify the hourly activity as reported on logs. It is understood, that in the case of the Austin facility, since only Stage II services were being provided prior to the implementation of ARSA the facility was not given credit for working VFR traffic in the terminal area. As a special case an aggregate of the VFR traffic (Stage II) counts for each of the specified 7 days in the month of November, 1983 were provided by the facility in order to make viable traffic comparisons for ARSA operational confirmation evaluation. For the post-ARSA period, a request for 31 days of data sets of the same types was made to both of the lead site facility managers, allowing for the selection of seven comparable days in terms of weather and facility status conditions.

3.3 DATA ANALYSIS

The basic purpose of the study was to evaluate the effects of ARSA by comparing pre-ARSA to post-ARSA operations at the two sites, with Austin operating as Level III and Columbus as a Level IV facility. At each site, the comparison was based on the similarity of field conditions during the pre- and post-ARSA periods. The analysis was based on two types of data collected during the operational confirmation period: (1) traffic activity profile and, (2) opinion surveys of pilots, controller/staff and facility supervisor/management.

EER's analysis effort was concentrated on the opinion survey data and the traffic characteristics of traffic mix, hourly shifts, and VFR/GA traffic trends. EER also reviewed other available published and historical data relating to the two lead sites in order to supplement data collected during the confirmation period.

The following analysis approach was adopted for ARSA confirmation at the two lead sites:

- Pilots, controllers/staff, supervisors/management opinion data analysis, and integration of their responses focusing on preceived safety, perceived delays, controllers workload and overall reaction towards participating in ARSA.

- Comparison of pre- and post-ARSA TRACON traffic counts for selected hours of the 7 days sample under similar weather conditions.

- Analysis of other available traffic counts data, flight plans, flight progress strips and historical data to supplement the results and observations made on the basis of 7 days of TRACON traffic counts comparison.

3.3.1 Survey Data Analysis

EER developed a comprehensive survey data collection plan on the basis of three questionnaires designed separately for pilots, controllers/staff, and supervisors/management. The survey was conducted during the months of June, July and August of 1984. The pilot survey was based on a stratified random sample drawn from all the registered pilots living in the lead site areas. The pilot sample was stratified by certificate types of air transport, commercial, private and student categories. A complete listing of the registered local pilots by certificate types for both lead sites was obtained from the FAA's Data Services Division at the Mike Monroney Aeronautical Center who maintain and semi-annually update the Airmen Directory file. For the controller and supervisory/management staff survey, questionnaires were mailed to all facility personnel.

For the pilot survey, EER's approach provided for first and second questionnaire mailings and a telephone survey. The second mailing and telephone survey were conducted to maximize the response rate from the selected sample group of pilots. The sequence and chronology of events which led to the accumulation of the pilot survey data is provided below.

- OMB Approval of Pilot Questionnaire — May 2, 1984
- First Mailing of Pilot's Questionnaire to the selected sample — May 30, 1984
- Pilot Questionnaire made available in Columbus and Austin Areas for itinerant pilots — June 4, 1984
- Second Mailing of Pilot's Questionnaire — July 17, 1984
- Telephone Survey of Pilots — August 13-17, 1984

The telephone survey was conducted between the hours of 6 pm and 9 pm EST in the Columbus, Ohio Area and between 6 pm and 10 pm EST in the Austin, Texas Area. Follow-up dates of August 18 and August 20 were provided for specific requests from pilots to call back at another time. Each non-respondent pilot was telephoned a minimum of 3 times in an effort to receive maximum data, unless the pilot stated that he/she had already returned the questionnaire, was not current as a pilot and therefore felt unqualified to answer, or simply stated that he/she did not wish to respond.

It is important to note that from the telephone interviews it was learned that most of those pilots who did not respond previously did not object to the ARSA concept. Rather, they felt unqualified to do so since they were not current pilots and therefore were unfamiliar with ARSA.

3.3.1.1 Pilots Sample Size and Stratification

Using the method of stratification with proportional allocation, a random stratified sample of 1150 pilots was chosen from a total of 6,128 registered pilots in the Austin, Texas area and 3,439 registered pilots in the Columbus, Ohio area. For this type of stratification, a self-weighting system is automatically placed in the sample selection process. The proportional allocation of the sample n_h means that the sampling fraction is the same in all strata. That is,

$$\frac{n_h}{n} = \frac{N_h}{N} \quad , h = 1, 2, \ldots L$$

where

- N: total population size
- N_h: population size of strata h
- n: total sample size
- n_h: sample size of strata h
- L: number of strata in the sample

The value n is given:

$$n = \frac{\frac{PQt^2}{d^2}}{1 + \frac{1}{N}\left(\frac{t^2PQ}{d^2} - 1\right)}$$

and

- d = the amount of error tolerable in the sample estimate.
- t = the abscissa of the normal curve that cuts off an area of α at the tails.
- P = Q = 0.5, assuming this value for P and Q in order to have the most conservative estimate of n.
- α = the risk incurred in case the actual error is larger than d.

For $\alpha = 0.01$; $t = 1.96$ and $d = 5\%$ the stratification and sample sizes of local pilots in the Austin, Texas and Columbus, Ohio areas are as follows:

	Austin, Texas		Columbus, Ohio	
CERTIFICATE TYPE/STRATUM	POP (N_h)	SAMPLE (n_h)	POP (N_h)	SAMPLE (n_h)
Air Transport (ATR)	696	68	286	46
Commercial (COM)	2012	196	780	126
Private (PVT)	2171	211	1667	268
Student (STU)	1249	121	706	114
TOTAL	6128	596	3439	554

3.3.1.2 Controllers/Staff and Supervisor/Management Survey

All the facility personnel at both sites were mailed ARSA questionnaires. The size of controllers/staff and supervisors/management who actually participated in the survey are listed below:

	Austin, Texas	Columbus, Ohio
CONTROLLERS/STAFF	32	44
SUPERVISORS/MANAGEMENT	7	8

3.3.1.3 Opinion Survey Response Summary

Figure 8 provides overall all questionnaire response data received up to August 30, 1984, from local pilots, controllers, supervisors/management staff and itinerant pilots from the Austin, Texas and Columbus, Ohio areas. Under the pilot's sample group, there were 30 "unable to forward" cases (wrong addresses). Under the controllers group there was 1 "unable to forward" case. The response rate given in the last column of Figure 8 reflects the actual percentage of completed questionnaires received for each category.

The total response rates under the three groups, pilots, controllers/staff, and supervisors/management were 51%, 75% and 87%, respectively. The response rate for itinerant pilots is not reflected in the figure because the actual number of questionnaires picked up by itinerants is not available.

3.3.1.4 Pilot's Opinion Survey Analysis

The pilot questionnaire was designed to be simple and quick to answer so that everyone would respond. Questions 11 through 20 of the questionnaire are statements about specific ARSA issues and ask for their subjective responses. Question-by-question responses of the 569 returned questionnaires from local pilots are provided in Appendix E.

The results of the itinerant pilot questionnaire responses have been analyzed separately. Question-by-question responses from each of the 146 itinerant pilots can be referred to in Appendix F.

In order to compare reactions among pilots in the various categories and determine the degree of homogenity of support for the ARSA, selected questions of local pilots responses have also been

	Total Size of Sample	Number of Responses	Response Rate
LOCAL PILOTS			
• Austin, Texas	576*	268	47%
• Columbus, Ohio	544*	301	55%
TOTAL	1120*	569	51%
CONTROLLER/STAFF			
• Austin, Texas	32	18	
• Columbus, Ohio	43*	34	
TOTAL	75*	56**	75%
MANAGEMENT/SUPERVISORS			
• Austin, Texas	7	7	100%
• Columbus, Ohio	8	6	75%
TOTAL	15	13	87%
ITINERANT PILOTS			
• Austin, Texas		56	
• Columbus, Ohio		90	
TOTAL		146	

*These numbers reflect the actual questionnaire data after deduction from the sample for "unable to forward" addresses.

**There were four controllers who crossed out their I.D. numbers; therefore, it is not known whether they are from Austin or Columbus.

Figure 8. Questionnaire Response Data

cross-tabulated for flight type (IFR/VFR), type of certificates held, frequent and infrequent flyer, and primary/satellite/secondary airports. Frequent flyers are defined as pilots who on the average flew 11 times or more per month during the period of December 1983 to April 1984; infrequent flyers are pilots who flew less than 11 times per month during the same time period.

To interpret the various cross-tabulations presented in this section, the explanation for frequency, percentage, row percent and column percent is provided.

Frequency counts: the number of times the indicated values of the two variables both appear in an observation.

Percent: the percentage of the total frequency count represented by the cell.

Row pct (or the row percentage): the percent of the total frequency count for that row represented by the cell.

Col pct (or column percent): the percent of the total frequency count for that column represented by the cell.

The following are the results of the pilot survey summarized by groups of questions which correspond to the ARSA evaluation objectives in Section 3.1.

Understanding of ARSA Concept and Consistency of Services, Simplicity of Shape, Dimension and FAA Charts of ARSA

- Understanding of ARSA Concept and Consistency of Services

  Approximately 75% of the respondents surveyed understand the services available within the ARSA. The extent and level of ATC services provided to the airspace users has been consistent as reported by more than 70% of the respondents. This is a significant and positive reflection of the NAR task groups recommendation that ARSA would be a simple, well defined, and easy to understand airspace concept. Sixty-nine percent of the respondents learned about the services provided in ARSA through FAA public meetings, FAA publications, and Letters to the Airmen.

- ARSA Shape, Dimensions and Depiction on FAA Charts

  Approximately 67% of the respondents agreed with the shape, dimensions and depiction of ARSA on FAA charts and only 6% to 9% disagreed with the present depiction and dimensions. From the written remarks accompanying the questionnaire, some pilots feel that 2200 and 2500 MSL floor segments on the current ARSA promote unsafe conditions. The pilots feel that current design does not really stand out very well on the sectional charts.

- Frequency Informaton on FAA Charts

  Sixty-four percent of the respondents agree with the ARSA frequency information depiction on FAA charts. About 9% of the respondents did not agree. Our review of pilot comments do not reveal any remarks which reflect dissatisfaction with frequency information.

Perceived Safety

Safety is one of the most important considerations when implementing new airspace rules and procedures into the national airspace system. It is significant to note that 70 percent of the pilots feel that safety is enhanced by participation of all aircraft within ARSA. Although some pilot's written remarks expressed concern over the congestion on ATC radio frequencies and the requirement to use higher radio frequencies, 76 percent felt that two-way radio communication requirements are acceptable.

Application of marginal homogeneity test by cross-tabulating the responses to the safety question with that of flight type (IFR/VFR), frequent and infrequent flyers, certificates held, and the specific lead site, show that local pilots homogeneously agree that safety is enhanced due to participation of all aircraft within ARSA. For example, the response percentages under the flight type IFR/VFR are 78% and 71%; frequent and infrequent flyers are 68% and 70%; certificate types range from 68% to 72%; and the lead sites are 72% for Austin, 68% for Columbus. Tables 2, 3, 4, 5 illustrate the cross-tabulation results.

Perceived Impact On Pilot's Flying

A majority of the respondents (56%) felt that implementation of the ARSA has caused no change to their flying while 25% felt that an increase in radio contacts has occurred. About 10% felt that they have either altered their route of flight, their altitude, or both to avoid ARSA.

Table 6 illustrates the distribution of perceived impact on pilots by whether they are based at a primary airport, satellite airport or secondary airport. It can be noticed that the impact on pilot flying patterns has not been significantly different among pilots from different aircraft bases. For example, in terms of increased radio contacts, the response percentages are 31% for primary airport, 33% for satellite airport, and 28% for secondary airport.

Reaction Towards Participation In ARSA

Of the pilot respondents, 62 percent have expressed a positive reaction to participating in ARSA. The GA pilot, considered to be the most affected by ARSA, is positive towards participation in ARSA. Our analysis shows that more than 70% of the GA pilots who are frequent flyers react positively to participating in ARSA.

Cross-tabulations of reaction towards participation in ARSA by certificates held, flight type (IFR/VFR), frequent and infrequent flyers, and the lead sites are illustrated in Tables 7, 8, 9 and 10. The marginal homogeneity test reveals that pilot support for participation in ARSA is homogeneously strong among the various pilot categories. For example, the response percentages under the different sub-populations of certificate types range from 60% to 68%; for IFR/VFR flight types 62% and 69%; for frequent and infrequent flyers 61% and 66%. For both lead sites the response percentage is 62%.

3.3.1.5 Itinerant Pilots' Opinions Analysis

Itinerant pilots, defined as those not based in the area but flying within the ARSA, were requested to pick up questionnaires from the fixed base operators (FBO) or flight service station (FSS) at

Table 2: Safety is Enhanced vs. Flight Type (IFR/VFR) – Cross Tabulation of Responses to Questions 13 and 8

Frequency Percentage Row Pct Col Pct	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	No Answer	TOTAL
Both	6	4	3	0	0	0	13
	1.05	0.70	0.53	0.00	0.00	0.00	2.28
	46.15	30.77	23.08	0.00	0.00	0.00	
	3.53	1.75	3.90	0.00	0.00	0.00	
IFR	33	50	10	8	3	2	106
	5.80	8.79	1.76	1.41	0.53	0.35	18.63
	31.13	47.17	9.43	7.55	2.83	1.89	
	19.41	21.93	12.99	21.05	20.00	4.88	
VFR	127	170	56	29	12	23	417
	22.32	29.88	9.84	5.10	2.11	4.04	73.29
	30.46	40.77	13.43	6.95	2.88	5.52	
	74.71	74.56	72.73	76.32	80.00	56.10	
No	4	4	8	1	0	16	33
Answer	0.70	0.70	1.41	0.18	0.00	2.81	5.80
	12.12	12.12	24.24	3.03	0.00	48.48	
	2.35	1.75	10.39	2.63	0.00	39.02	
TOTAL	170	228	77	38	15	41	569
	29.88	40.07	13.53	6.68	2.64	7.21	100.00

both lead sites. A total of 146 itinerants responded as indicated in Figure 8. A majority of them had positive reactions towards participating in the ARSA and reflected opinions similar to those of the local pilots. The responses by the itinerant pilots to the opinion questions 12 to 20 are summarized in Figure 9. Appendix F gives the question-by-question response data for the 146 itinerant pilots who participated in this survey.

3.3.1.6 Opinions of Military Pilots and Controllers

The military pilots in these two lead site areas were not specifically identified as a part of the sample who were mailed the questionnaires since the FAA felt that the military had to be treated differently. However, some of them may have received and responded if they were also registered as civilian pilots. A group of questionnaires were sent through the NAR DOD liaison officer to the military commanders at the bases at the two lead site areas. A total of twenty military personnel responses were received. The summary opinion of the responding military personnel strongly favors ARSA implementation.

Table 3: Safety is Enhanced vs. Frequent/Infrequent Flyer – Cross Tabulation of Responses to Questions 13 and 7

Frequency Percentage Row Pct Col Pct	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	No Answer	TOTAL
Frequent Flyer	40 7.03 35.09 23.53	38 6.68 33.33 16.67	14 2.46 12.28 18.18	15 2.64 13.16 39.47	7 1.23 6.14 46.67	0 0.00 0.00 0.00	114 20.04
Infre-quent Flyer	130 22.85 28.57 76.47	190 33.39 41.76 83.33	63 11.07 13.85 81.82	23 4.04 5.05 60.53	8 1.41 1.76 53.33	41 7.21 9.01 100.00	455 79.96
TOTAL	170 29.88	228 40.07	77 13.53	38 6.68	15 2.64	41 7.21	569 100.00

Typically 14 out of the 20 military responses indicated that ARSA has not impacted their operations in any way, and only 5 out of the 20 responses indicated that an increase in radio contacts with ATC was experienced.

Four of the military controllers who responsed felt that safety was enhanced, that there was no increase in delays, and that controller workload has increased.

3.3.1.7 Controllers Opinion Survey Analysis

From the questionnaire responses, a majority of the controllers reflect that they have experienced an increase in workload on the order of 30%. Thirty-six percent (36%) of the controllers noticed an increase in radio communications and 34% have some difficulty in implementing ARSA procedures. On the other hand, controllers felt that safety is enhanced, delays have not resulted, more pilots are participating, pilots have a positive reaction towards ARSA and that they have a good understanding of the airspace structure. The following figures indicate actual percentages of the controllers responding who agree and strongly agree to these specific issues. These numbers are based on 75% response rate from a total of 75 controllers contacted at both lead sites. Eighty percent (80%) of the controllers who responded have worked both in the radar room and tower and 66% of the respondents have more than 10 years of ATC experience.

Table 4: Safety is Enhanced vs. Certificate Type — Cross Tabulation of Responses to Questions 13 and 1

Frequency / Percentage / Row Pct / Col Pct	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	No Answer	TOTAL
Student	21	19	8	1	0	7	56
	3.69	3.34	1.41	0.18	0.00	1.23	9.84
	37.50	33.93	14.29	1.79	0.00	12.50	
	12.35	8.33	10.39	2.63	0.00	17.07	
Private	74	110	36	11	5	21	257
	13.01	19.33	6.33	1.93	0.88	3.69	45.17
	28.79	42.80	14.01	4.28	1.95	8.16	
	43.53	48.25	46.75	28.95	33.33	51.22	
Commer-	52	68	19	19	7	12	177
cial	9.14	11.95	3.34	3.34	1.23	2.11	31.11
	29.38	38.42	10.73	10.73	3.95	6.78	
	30.59	29.82	24.68	50.00	46.67	29.27	
Air	20	25	11	7	3	0	66
Trans-	3.51	4.39	1.93	1.23	0.53	0.00	11.60
port	30.30	37.88	16.67	10.61	4.55	0.00	
	11.76	10.96	14.29	18.42	20.00	0.00	
No	3	6	3	0	0	1	13
Answer	0.53	1.05	0.53	0.00	0.00	0.18	2.28
	23.08	46.15	23.08	0.00	0.00	7.69	
	1.76	2.63	3.90	0.00	0.00	2.44	
TOTAL	170	228	77	38	15	41	569
	29.88	40.07	13.53	6.68	2.64	7.21	100.00

Specific Controller Questionnaire Issues	Percentage of Respondents Who Agree and Strongly Agree
• No increased delays as a result of ARSA	63%
• Safety is enhanced because of participation of all aircraft within ARSA boundary	57%
• Pilot participation is higher in ARSA than prior to ARSA implementation	83%
• Pilots understand the size and shape of ARSA	50%
• Controller workload under ARSA has increased	71%

Table 5: Safety is Enhanced vs. Site – Cross Tabulation of Responses to Question 13 and Lead Site

Frequency Percentage Row Pct Col Pct	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	No Answer	TOTAL
Austin	83	111	29	18	6	21	268
	14.59	19.51	5.10	3.16	1.05	3.69	47.10
	30.97	41.42	10.82	6.72	2.24	7.84	
	48.82	48.68	37.66	47.37	40.00	51.22	
Columbus	87	117	48	20	9	20	301
	15.29	20.56	8.44	3.51	1.58	3.51	52.90
	28.90	38.87	15.95	6.64	2.99	6.64	
	51.18	51.32	62.34	52.63	60.00	48.78	
TOTAL	170	228	77	38	15	41	569
	29.88	40.07	13.53	6.68	2.64	7.21	100.00

Question-by-question responses of the controllers to the complete questionnaire can be seen in Appendix G.

3.3.1.8 Supervisor/Management Opinion Survey Analysis

A total of 15 supervisors/managers were contacted to participate in the ARSA confirmation survey and 13 of them responded. The respondents had a very positive reaction towards the implementation of ARSA at their facilities. A majority of them felt that there have been fewer complaints after the implementation of ARSA and the administration of the facility has been more or less the same. Almost all of the supervisors/managers support the continuation of ARSA operations at their facilities. The percentages below indicate the actual responses from the supervisor/management staff to the specific questions who agree and strongly agree.

Specific Management Questionnaire Issues	Percentage of Respondents Who Agree and Strongly Agree
• Fewer complaints from the flying public	84%
• Fewer complaints from controller staff	61%
• Safety is enhanced	61%
• Administration of the facility has been the same	61%
• ARSA operations should be continued indefinitely	92%
• ARSA should be implemented nationally all present TRSA locations.	69%

Table 6: Impact on Flying vs. Aircraft Location – Cross Tabulation of Responses to Questions 11 and 5

Frequency Percentage Row Pct Col Pct	No Change	Increased Radio	Altered Alt.	Altered Rt.	Other	Altered Both	No Answer	Total
No Answer	24	6	0	1	0	2	10	43
	4.22	1.05	0.00	0.18	0.00	0.35	1.76	7.56
	55.81	13.95	0.00	2.33	0.00	4.65	23.26	
	7.55	4.14	0.00	6.25	0.00	6.45	29.41	
Others	142	52	4	9	9	21	14	251
	24.96	9.14	0.70	1.58	1.58	3.69	2.46	44.11
	56.57	20.72	1.59	3.59	3.59	8.37	5.58	
	44.65	35.86	33.33	56.25	69.23	67.74	41.18	
Primary Airport	81	42	2	1	2	2	5	135
	14.24	7.38	0.35	0.18	0.35	0.35	0.88	23.73
	60.00	31.11	1.48	0.74	1.48	1.48	3.70	
	25.47	28.97	16.67	6.25	15.38	6.45	14.71	
Satellite Airport	49	34	2	5	1	4	4	101
	8.61	5.98	0.70	0.88	0.18	0.70	0.70	17.75
	48.51	33.66	3.96	4.95	0.99	3.96	3.96	
	15.41	23.45	33.33	31.25	7.69	12.90	11.76	
Secondary Airport	22	11	2	0	1	2	1	39
	3.87	1.93	0.35	0.00	0.18	0.35	0.18	6.85
	56.41	28.21	5.13	0.00	2.56	5.13	2.56	
	6.92	7.59	16.67	0.00	7.69	6.45	2.94	
TOTAL	318	145	12	16	13	31	34	569
	55.89	25.48	2.11	2.81	2.28	5.45	5.98	100.00

Table 7: Positive Reaction Towards Participating in ARSA vs. Certificate Type – Cross Tabulation of Responses to Questions 20 and 1

Frequency Percentage Row Pct Col Pct	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	No Answer	TOTAL
Student	12	26	7	1	0	10	56
	2.11	4.57	1.23	0.18	0.00	1.76	9.84
	21.43	46.43	12.50	1.79	0.00	17.86	
	13.04	10.00	6.93	2.22	0.00	20.83	
Private	36	117	56	17	7	24	257
	6.33	20.56	9.84	2.99	1.23	4.22	45.17
	14.01	45.53	21.79	6.61	2.72	9.34	
	39.13	45.00	55.45	37.78	30.43	50.00	
Commercial	33	79	27	14	11	13	177
	5.80	13.88	4.75	2.46	1.93	2.28	31.11
	18.64	44.63	15.25	7.91	6.21	7.34	
	35.87	30.38	26.73	31.11	47.83	27.08	
Air	9	32	8	13	4	0	66
Transport	1.58	5.62	1.41	2.28	0.70	0.00	11.60
	13.64	48.48	12.12	19.70	6.06	0.00	
	9.78	12.31	7.92	28.89	17.39	0.00	
No	2	6	3	0	1	1	13
Answer	0.35	1.05	0.53	0.00	0.18	0.18	2.28
	15.38	46.15	23.08	0.00	7.69	7.69	
	2.17	2.31	2.97	0.00	4.35	2.08	
TOTAL	92	260	101	45	23	48	569
	16.17	45.69	17.75	7.91	4.04	8.44	100.00

Table 8: Positive Reaction Towards Participating in ARSA vs. Flight Type (IFR/VFR) – Cross Tabulation of Responses to Questions 20 and 8

Frequency / Percentage / Row Pct / Col Pct	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	No Answer	TOTAL
Both	3	8	2	0	0	0	13
	0.53	1.41	0.35	0.00	0.00	0.00	2.28
	23.08	61.54	15.38	0.00	0.00	0.00	
	3.26	3.08	1.98	0.00	0.00	0.00	
IFR	21	52	17	9	5	2	106
	3.69	9.14	2.99	1.58	0.88	0.35	18.63
	19.81	49.06	16.04	8.49	4.72	1.89	
	22.83	20.00	16.83	20.00	21.74	4.17	
VFR	65	195	78	34	18	27	417
	11.42	34.27	13.71	5.98	3.16	4.75	73.29
	15.59	46.76	18.71	8.15	4.32	6.47	
	70.65	75.00	77.23	75.56	78.26	56.25	
No	3	5	4	2	0	19	33
Answer	0.53	0.88	0.70	0.35	0.00	3.34	5.80
	9.09	15.15	12.12	6.06	0.00	57.58	
	3.26	1.92	3.96	4.44	0.00	39.58	
TOTAL	92	260	101	45	23	48	569
	16.17	45.69	17.75	7.91	4.04	8.44	100.00

Question-by-question responses of the supervisors/management staff to the complete questionnaire are given in Appendix H.

3.3.2 Physical Data Analysis

Lead Site physical data was analyzed to evaluate the effect of ARSA on traffic characteristics and to determine the possible change in the level of controller activities. Physical data analysis focused on the number of TRACON traffic counts as the key variable for comparison during pre- and post-ARSA periods. The analysis was also based on the following assumptions: (1) ATC manpower (controllers manning the facility) was the same in the pre- and post-ARSA periods, and (2) ground system capabilities, runway acceptance rate, approach patterns and the level of services offered were the same in the pre- and post-ARSA periods. Total TRACON count at any facility is a function of and limited by the airport design capacity, runway, taxiway and other groundside restrictions, prevalent weather conditions and degree of aircraft operational flight compatibility with satellite/secondary airports. At any given time, only a certain number of aircraft operations can be accommodated and offered the desired level of services. Consequently, the change in the number of TRACON traffic counts is a fairly good reflection of ARSA effect on the traffic in the area and a good indicator of controller activity effects.

Table 9: Positive Reaction Towards Participating in ARSA vs. Frequent/Infrequent Flyer – Cross Tabulation of Responses to Questions 20 and 7

Frequency Percentage Row Pct Col Pct	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	No Answer	TOTAL
Frequency	27	48	14	17	8	0	114
Flyer	4.75	8.44	2.46	2.99	1.41	0.00	20.04
	23.68	42.11	12.28	14.91	7.02	0.00	
	29.35	18.46	13.86	37.78	34.78	0.00	
Infrequent	65	212	87	28	15	48	455
Flyer	11.42	37.26	15.29	4.92	2.64	8.44	79.96
	14.29	36.59	19.12	6.15	3.30	10.55	
	70.65	81.54	86.14	62.22	65.22	100.00	
TOTAL	92	260	101	45	23	48	569
	16.17	45.59	17.75	7.91	4.04	8.44	100.00

Table 10: Positive Reaction Towards Participating in ARSA – Cross Tabulation of Responses to Question 20 and Lead Site

Frequency Percentage Row Pct Col Pct	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree	No Answer	TOTAL
Austin	44	123	45	19	12	25	268
	7.73	21.62	7.91	3.34	2.11	4.39	47.10
	16.42	45.90	16.79	7.09	4.48	9.33	
	47.83	47.31	44.55	42.22	52.17	52.08	
Columbus	48	137	56	26	11	23	301
	8.44	24.08	9.84	4.57	1.93	4.04	52.90
	15.95	45.51	18.60	8.64	3.65	7.64	
	52.17	52.69	55.45	57.78	47.83	47.92	
TOTAL	92	260	101	45	23	48	569
	16.17	45.69	17.75	7.91	4.04	8.44	100.00

PERSONAL OPINION	STRONGLY AGREE	AGREE	INDIFFERENT	DISAGREE	STRONGLY DISAGREE	NO ANSWER
12) Generally understand the services available within the ARSA.	23%	51%	13%	5%	4%	4%
13) Safety is enhanced due to participation of all aircraft within the ARSA.	25%	31%	14%	14%	15%	1%
14) Given similar flight situations, the service provided to you by ATC was consistent.	17%	54%	10%	13%	3%	3%
15) The two-way radio communication requirements within the ARSA are acceptable.	21%	45%	9%	7%	15%	3%
16) The shape of the ARSA is acceptable.	17%	49%	15%	4%	12%	3%
17) The dimensions of the ARSA are acceptable.	16%	45%	13%	12%	11%	3%
18) ARSA depiction on FAA charts is acceptable.	16%	45%	21%	10%	4%	4%
19) ARSA frequency information on FAA charts is acceptable.	12%	48%	24%	6%	5%	5%
20) Reaction to participating in the ARSA is positive.	17%	36%	12%	11%	21%	3%

Figure 9. Itinerant Pilot Questionnaire Responses (Response Percentages to Opinion Questions)

The weather plays a dominant role in any traffic situation, and it governs the flight type IFR/VFR as well as the ability of the ATC system to meet the demand. Also the airport traffic displays distinct characteristics by the month of the year, the day of the week and by the hour of the day. Therefore the selection of the post-ARSA sample of 7 days was based on the following criteria which provides the closest comparison of the pre- and post-ARSA data.

- Day of the week
- Similar weather dependent observations:
  - sky cover
  - visibility
  - wind speed
  - IFR/VFR ratio

The TRACON traffic count analyzed is for 7 days (Monday through Sunday) for both the pre- and post-ARSA periods. The seven selected days from the post-ARSA sample for the two lead sites are listed below:

	Austin	Columbus
Monday	March 19, 1984	April 2, 1984
Tuesday	March 27, 1984	April 10, 1984
Wednesday	March 7, 1984	April 11, 1984
Thursday	March 1, 1984	March 22, 1984
Friday	March 16, 1984	March 16, 1984
Saturday	March 10, 1984	April 14, 1984
Sunday	March 25, 1984	April 8, 1984

The typical day's operations in the pre-ARSA period were compared to a corresponding operational period in the post-ARSA period on a hour to hour basis, to determine if there were any changes in total activity and/or distribution of flight operations.

For weather comparisons, the 24 hour surface weather observations of sky cover, visibility and wind speed were taken into consideration. All the 24 hour surface weather observations for the total of 38 days each (7 days of pre-ARSA and 31 days of post-ARSA) of both lead sites have been charted and average scores calculated based on the observations of clear, partly cloudy, and cloudy for sky cover; good, marginal and poor for visibility; and light, moderate and strong for wind speeds. The alloted scores and the criteria is given in Appendix I. A weather difference profile of the selected seven days which provided the closest comparison is also given in Appendix I.

Traffic counts data anlayzed is representative of the busy hours as well as slow activity hours of the overall traffic behavior at the two lead sites. The ARSA effect on traffic activity may possibly lead to shifts in hourly activity to avoid the peak or busy hour conditions, especially the GA operators flying VFR, avoidance of ARSA airspace core resulting in less traffic counts, or benefit of increased radar participation within ARSA resulting in more traffic counts. The analysis and charts referred to in the following sections are based on local standard time. The instrument operations count between midnight and 1:00 a.m. are counted in time slot zero (0000 hr). Similarly, activity occurring between 12:00 noon and 1:00 p.m. is assigned to time slot 1200 hr.

3.3.2.1 Traffic Distribution

The distributions of hourly traffic counts show similar trends and peaking characteristics in pre- and post-ARSA periods, as shown in Appendix J. Traffic peaks occur during the time slots 0800 hour to 1000 hour in the mornings and 1400 hour to 1800 hour in the evenings. For Columbus, the highest peak hour activity occurred on Wednesday (11-9-83) with 89 traffic counts during the pre-ARSA period and again on Wednesday (4-11-84) during the post-ARSA period with 105 traffic counts. For Austin, the highest peak hour activity during the pre-ARSA occurred on Friday (11-18-83) with 96 traffic counts and during the post-ARSA period on Wednesday (3-7-84) with 113 traffic counts. The maximum day (the day during which most operations occurred) was different in the case of Austin because runway 13L was closed throughout the post-ARSA Friday. Appendix K gives the details of the facility operations record.

Table 11 illustrates the summary TRACON traffic counts by flight type (IFR/VFR) for the selected pre- and post-ARSA 7 day periods.

Based on the 7 days of data, the daily average traffic counts for the two sites are:

	Pre-ARSA	Post-ARSA
• Robert Mueller Municipal Airport	759	842
• Port Columbus International Airport	818	909

The data shows that both sites have experienced an increase in traffic counts. The daily average IFR and VFR components of the total traffic counts are:

	Pre-ARSA			Post-ARSA				
	IFR Counts	VFR Counts	IFR/VFR Ratio	IFR Counts	VFR Counts	IFR/VFR Ratio	% Change in IFR Counts	% Change in VFR Counts
• Robert Mueller Municipal Airport	516	243	2.12	499	343	1.45	3%	41%
• Port Columbus International Airport	600	218	2.75	654	255	2.56	9%	17%

It is evident that at Robert Mueller Municipal Airport, the daily average VFR counts have increased by 41% while the IFR counts have decreased by 3%. At Port Columbus International Airport, the daily average VFR counts have increased by 17% and IFR counts by 9% during the post-ARSA period. The IFR/VFR traffic count distributions for the selected seven days (Monday through Sunday) are shown in Figures 10A and 10B for the two sites.

Table 11: Numerical Summary of Seven Days of Pre- and Post-ARSA TRACON Traffic Counts by Flight Category (IFR/VFR)

A. ROBERT MUELLER MUNICIPAL AIRPORT – AUSTIN, TEXAS

	PRE-ARSA				POST-ARSA			
DAY	DATE	IFR	VFR	TOTAL	DATE	IFR	VFR	TOTAL
Monday	11-21-83	521	235	756	3-19-84	525	291	816
Tuesday	11-22-83	716	106	822	3-27-84	561	322	883
Wednesday	11-16-83	460	388	848	3-07-84	503	656	1159
Thursday	11-17-83	524	342	866	3-01-84	591	400	991
Friday	11-18-83	682	208	890	3-16-84	622	143	765
Saturday	11-19-83	410	132	542	3-10-84	466	179	645
Sunday	11-20-83	298	290	588	3-25-84	227	408	635
Grand Total		3611	1701	5312		3495	2399	5894

B. PORT COLUMBUS INTERNATIONAL AIRPORT – COLUMBUS, OHIO

	PRE-ARSA				POST-ARSA			
DAY	DATE	IFR	VFR	TOTAL	DATE	IFR	VFR	TOTAL
Monday	11-14-83	555	235	790	4-02-84	541	304	845
Tuesday	11-08-83	682	378	1060	4-10-84	783	418	1201
Wednesday	11-09-83	753	359	1112	4-11-84	809	497	1306
Thursday	11-10-83	837	46	883	3-22-84	805	40	845
Friday	11-11-83	657	21	678	3-16-84	811	73	884
Saturday	11-12-83	379	257	636	4-14-84	453	138	591
Sunday	11-13-83	334	231	565	4-08-84	378	315	693
Grand Total		4197	1527	5724		4580	1785	6365

ROBERT MUELLER MUNICIPAL AIRPORT
AUSTIN, TEXAS

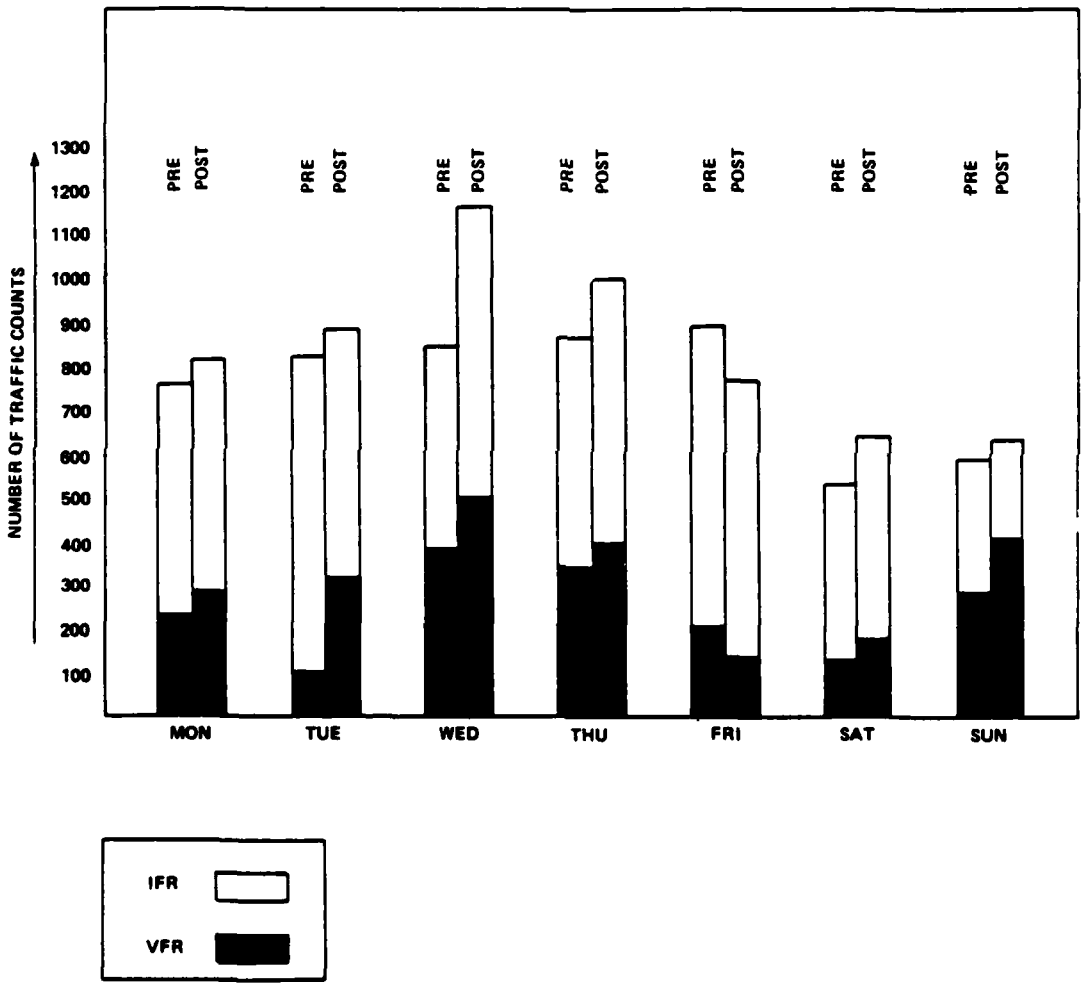


Figure 10A: Distribution of IFR and VFR Counts in Pre- and Post-ARSA Periods

PORT COLUMBUS INTERNATIONAL AIRPORT
COLUMBUS, OHIO

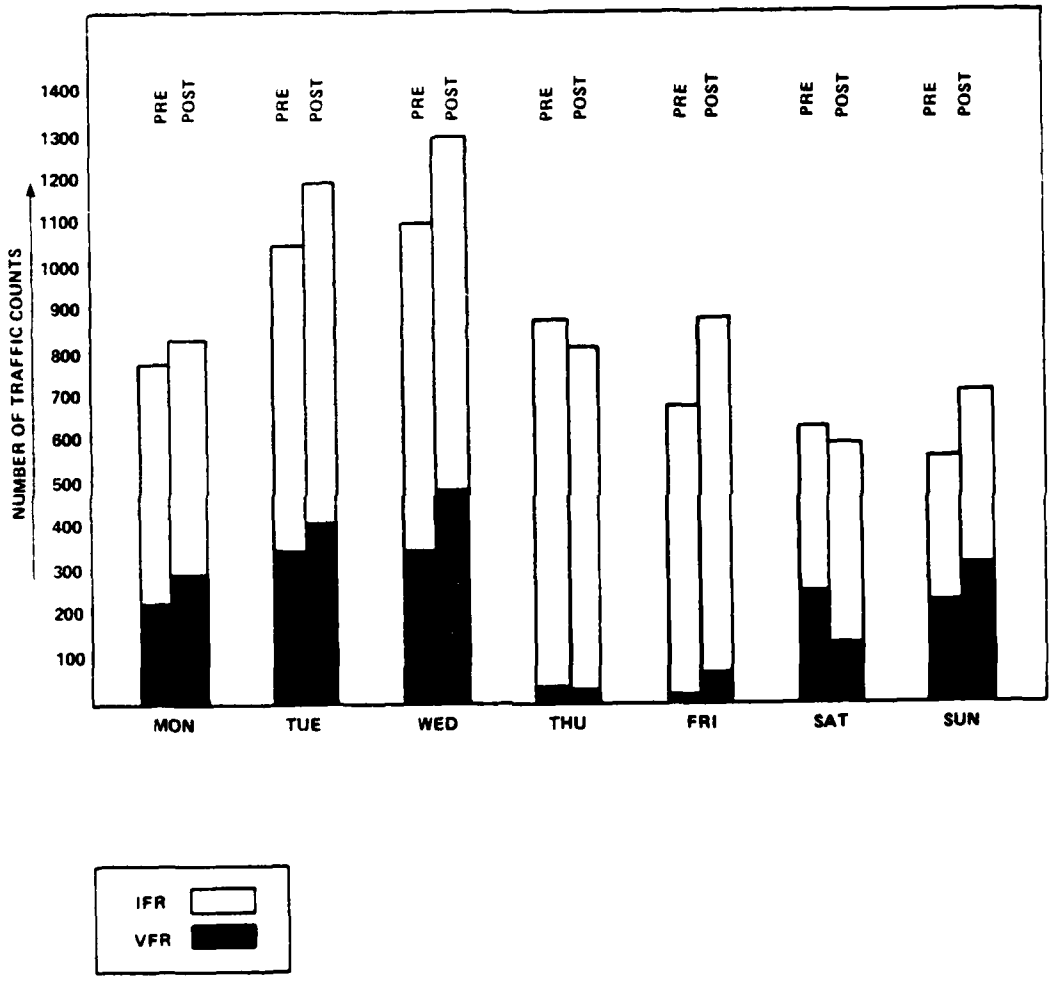


Figure 10B: Distribution of IFR and VFR Counts in Pre- and Post-ARSA Periods

Average Hourly Traffic Counts Profile: Based on the selected 7 days of TRACON traffic counts data, an average day hourly statistics of the counts by flight type (IFR/VFR) and by user category (AC, AT, GA and MIL) were generated. These statistics are illustrated in Tables 12 through 15. The numbers which appear in the cell under "average day" are averages in the sense that they represent the sum of the traffic counts in the specified hour for 7 days divided by the number of days. Thus, the average day information is a statistical summary of the week's activity. It does not represent the airport experience on any specific day. In contrast, the data in the cells under "maximum day" represent actual counts.

The average hourly traffic counts by flight type are shown graphically in Figures 11 and 12 for Austin and Columbus sites. Figures 13 and 14 depict graphically the hourly traffic distribution by user categories (AC, AT, GA and MIL). The Figures 11 and 12 illustrate the preponderance of IFR traffic. Figures 13 and 14 illustrate the preponderance of GA activity during the busy hours, at both the lead sites. The busy hour is defined to be the hour when the traffic counts for that hour are equal to or greater than the average for the day. Time slots from 0800 hour to 1900 hour are considered to be the busy hours based on the comparison of pre- and post-ARSA "average day" counts. The busy hour traffic counts account for more than 72% of the traffic on an "average day" for the Columbus site and more than 84% of the traffic for the Austin site.

The Figures 11-14 depict that there has been no noticeable shifts in the hourly activity profile from pre- to post-ARSA period at either lead site.

Based on the data given in Tables 14 and 15 the general aviation component increase in the post-ARSA period contributes about 28% towards the overall increase in traffic counts at Robert Mueller Municipal Airport. At Port Columbus International Airport, the general aviation component increase contributes about 70% towards the overall increase in traffic counts during the post-ARSA period.

3.3.2.2 Traffic Mix

Traffic Mix figures for the "average day" during the pre- and post-ARSA periods are reflected in the pie charts shown in Figure 15. It is evident from the charts that the traffic mix worked by the controllers at Austin and Columbus site has remained practically the same during pre- and post-ARSA periods. In the case of Austin, the facility provided Stage II VFR traffic counts during the pre-ARSA period as an aggregate and not by user categories of AC, AT, GA, and MIL. For estimating traffic mix, the Stage II VFR traffic is counted as GA traffic, consequently traffic mix ratios for GA in the pre-ARSA period shown in Figure 15 for the Austin facility is higher than expected. These data sets reflect the typical traffic pattern of the two lead sites.

3.3.2.3 Overflight Traffic

Due to the ARSA implementation it was also expected that some amount of overflight traffic typically general aviation/air taxi might change routes of travel/flight altitudes especially during busy hour conditions of the airport to avoid congestion. In order to evaluate this particular aspect, the flight progress strips data provided by each of the facilities was analyzed. The following altitude stratra were chosen based on the published information on sectional aeronautical charts for Austin and Columbus airports.

Table 12(A): Hourly Traffic Counts by Flight Type – Pre-ARSA

Robert Mueller Municipal Airport, Austin, Texas

	AVERAGE DAY			MAXIMUM DAY		
LOCAL TIME	IFR	VFR	TOTAL	IFR	VFR	TOTAL
0000	2	0	2	4	0	4
0100	1	0	1	3	1	4
0200	0	0	0	0	0	0
0300	0	0	0	2	0	2
0400	0	1	1	0	0	0
0500	1	0	1	0	0	0
0600	8	1	9	7	0	7
0700	24	5	29	45	0	45
0800	28	10	38	36	4	40
0900	37	15	52	44	4	48
1000	39	16	55	57	4	61
1100	36	20	56	43	15	58
1200	31	20	51	47	20	67
1300	34	18	52	48	8	56
1400	36	25	61	47	23	70
1500	37	23	60	67	29	96
1600	39	22	61	53	23	76
1700	38	25	63	44	29	73
1800	31	18	49	42	20	62
1900	23	12	35	24	19	43
2000	32	6	38	39	3	42
2100	17	4	21	13	5	18
2200	16	2	18	17	1	18
2300	6	0	6	0	0	0
TOTAL	516	243	759	682	208	890

Table 12(B): Hourly Traffic Counts by Flight Type – Post-ARSA

Robert Mueller Municipal Airport, Austin, Texas

	AVERAGE DAY			MAXIMUM DAY		
LOCAL TIME	IFR	VFR	TOTAL	IFR	VFR	TOTAL
0000	4	1	5	9	6	15
0100	1	0	1	0	0	0
0200	0	0	0	0	0	0
0300	0	0	0	0	0	0
0400	0	0	0	0	0	0
0500	1	0	1	0	0	0
0600	6	3	9	4	8	12
0700	27	6	33	32	20	52
0800	31	15	46	26	47	73
0900	37	24	61	41	69	110
1000	39	24	63	37	35	72
1100	32	25	57	28	42	70
1200	36	22	58	31	42	73
1300	29	23	52	19	43	62
1400	36	30	66	37	47	84
1500	37	34	71	38	50	88
1600	39	33	72	42	50	92
1700	34	38	72	34	79	113
1800	27	27	54	28	35	63
1900	22	17	39	19	27	46
2000	22	6	28	30	10	40
2100	14	7	21	13	18	31
2200	16	5	21	20	12	32
2300	9	3	12	15	16	31
TOTAL	499	343	842	503	656	1159

Table 13(A): Hourly Traffic Counts by Flight Type -- Pre-ARSA

Port Columbus International Airport, Columbus, Ohio

	AVERAGE DAY			MAXIMUM DAY		
LOCAL TIME	IFR	VFR	TOTAL	IFR	VFR	TOTAL
0000	22	8	30	35	16	51
0100	12	5	17	13	6	19
0200	7	5	12	7	6	13
0300	18	3	21	30	9	39
0400	13	1	14	14	2	16
0500	8	2	10	8	3	11
0600	7	1	8	12	2	14
0700	27	2	29	30	5	35
0800	39	9	48	50	19	69
0900	35	11	46	44	22	66
1000	35	12	47	25	18	43
1100	29	11	40	39	16	55
1200	31	15	46	41	23	64
1300	33	16	49	43	22	65
1400	37	17	54	59	30	89
1500	32	17	49	26	23	49
1600	38	20	58	40	33	73
1700	43	18	61	48	40	88
1800	34	12	46	47	16	63
1900	27	8	35	36	14	50
2000	20	9	29	25	13	38
2100	22	8	30	42	12	55
2200	16	4	20	22	5	27
2300	15	4	19	16	4	20
TOTAL	600	218	818	753	359	1112

Table 13(B): Hourly Traffic Counts by Flight Type – Post-ARSA

Port Columbus International Airport, Columbus, Ohio

	AVERAGE DAY			MAXIMUM DAY		
LOCAL TIME	IFR	VFR	TOTAL	IFR	VFR	TOTAL
0000	22	5	27	26	8	34
0100	16	2	18	22	3	25
0200	5	3	8	7	3	10
0300	20	3	23	24	7	31
0400	14	0	14	27	2	29
0500	8	1	9	9	3	12
0600	11	1	12	11	3	14
0700	27	3	30	39	6	45
0800	36	11	47	45	21	66
0900	40	13	53	50	33	83
1000	31	18	49	40	36	76
1100	33	20	53	41	32	73
1200	29	16	45	33	31	64
1300	35	18	53	35	22	57
1400	37	25	62	46	48	94
1500	40	24	64	56	35	91
1600	50	22	72	60	45	105
1700	41	19	60	46	42	88
1800	42	19	61	42	40	82
1900	31	12	43	40	31	71
2000	25	7	32	32	14	46
2100	23	6	29	27	18	45
2200	21	4	25	30	8	38
2300	17	3	20	21	6	27
TOTAL	654	255	909	809	497	1306

Table 14(A): Hourly Traffic Counts by User Category – Pre-ARSA

Robert Mueller Municipal Airport, Austin, Texas

	AVERAGE DAY					MAXIMUM DAY				
LOCAL TIME	AC	AT	GA	MIL	TOTAL	AC	AT	GA	MIL	TOTAL
0000	0	0	1	0	1	0	1	3	0	4
0100	0	1	1	0	2	0	2	2	0	4
0200	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	1	1	0	2
0400	0	0	2	0	2	0	0	0	0	0
0500	0	0	1	0	1	0	0	0	0	0
0600	3	1	4	0	8	1	2	3	1	7
0700	11	3	14	0	28	13	9	23	0	45
0800	9	1	25	3	38	8	2	28	2	40
0900	12	1	30	8	51	11	2	27	8	48
1000	8	0	35	12	55	8	0	38	15	61
1100	9	0	35	13	57	11	1	31	15	58
1200	6	0	35	10	51	5	0	47	15	67
1300	9	1	32	10	52	12	2	26	16	56
1400	6	1	42	12	61	5	1	51	13	70
1500	10	1	41	9	61	10	0	72	14	96
1600	10	1	41	9	61	7	1	58	10	76
1700	11	1	44	7	63	10	1	54	8	73
1800	9	1	33	7	50	12	2	42	6	62
1900	6	2	22	6	36	5	1	34	3	43
2000	14	2	15	7	38	15	4	21	2	42
2100	6	1	9	4	20	7	1	10	0	18
2200	5	5	7	1	18	6	1	9	2	18
2300	2	0	3	0	5	0	0	0	0	0
TOTAL	146	23	472*	118	759	146	34	580	130	890

*Stage II VFR traffic is counted as GA.

Table 14(B): Hourly Traffic Counts by User Category – Post-ARSA

Robert Mueller Municipal Airport, Austin, Texas

	AVERAGE DAY					MAXIMUM DAY				
LOCAL TIME	AC	AT	GA	MIL	TOTAL	AC	AT	GA	MIL	TOTAL
0000	2	1	2	1	6	1	3	7	4	15
0100	0	0	0	0	0	0	0	0	0	0
0200	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0	0	0
0500	0	1	1	0	2	0	0	0	0	0
0600	2	2	4	0	8	1	4	7	0	12
0700	13	6	13	0	32	17	9	26	0	52
0800	11	5	28	2	46	11	3	55	4	73
0900	12	3	36	10	61	13	5	72	20	110
1000	11	0	38	14	63	11	0	45	16	72
1100	7	1	36	13	57	5	2	46	17	70
1200	11	0	36	12	59	12	0	49	12	73
1300	7	2	32	9	50	7	2	43	10	62
1400	10	3	40	13	66	11	3	49	21	84
1500	11	1	46	13	71	7	2	65	14	88
1600	13	1	47	12	73	14	1	64	13	92
1700	12	3	49	8	72	16	3	84	10	113
1800	8	1	38	7	54	9	0	44	10	63
1900	7	3	19	10	39	6	3	24	13	46
2000	9	2	10	7	28	12	2	24	2	40
2100	6	3	8	5	22	6	6	14	5	31
2200	8	5	7	1	21	11	12	8	1	32
2300	4	3	5	0	12	9	9	13	0	31
TOTAL	164	46	495	137	842	179	69	739	172	1159

Table 15(A): Hourly Traffic Counts by User Category – Pre-ARSA

Port Columbus International Airport, Columbus, Ohio

	AVERAGE DAY					MAXIMUM DAY				
LOCAL TIME	AC	AT	GA	MIL	TOTAL	AC	AT	GA	MIL	TOTAL
0000	1	18	11	0	30	1	30	20	0	51
0100	1	9	7	0	17	0	12	7	0	19
0200	1	5	5	0	11	1	6	5	1	13
0300	0	15	6	0	21	0	26	13	0	39
0400	0	10	5	0	15	0	12	4	0	16
0500	0	8	2	0	10	0	9	1	1	11
0600	0	4	4	0	8	0	5	9	0	14
0700	9	6	14	0	29	9	7	19	0	35
0800	9	9	28	1	47	9	15	44	1	69
0900	8	8	29	1	46	9	10	44	3	66
1000	8	6	29	4	47	7	6	25	5	43
1100	8	6	21	4	39	10	7	28	10	55
1200	9	6	27	4	46	8	7	32	17	64
1300	7	6	32	6	51	6	9	33	17	65
1400	8	11	33	3	55	9	17	58	5	89
1500	8	4	34	2	48	7	9	32	1	49
1600	12	7	38	1	58	13	7	50	3	73
1700	11	9	38	2	60	14	13	59	2	88
1800	10	9	25	2	46	12	12	35	4	63
1900	8	6	19	2	35	7	7	27	9	50
2000	8	5	16	1	30	9	8	18	3	38
2100	9	7	12	2	30	10	14	19	12	55
2200	6	7	8	0	21	5	12	10	0	27
2300	3	6	9	0	18	2	10	8	0	20
TOTAL	144	187	452	35	818	148	270	600	94	1112

Table 15(B): Hourly Traffic Counts by User Category – Post-ARSA

Port Columbus International Airport, Columbus, Ohio

	AVERAGE DAY					MAXIMUM DAY				
LOCAL TIME	AC	AT	GA	MIL	TOTAL	AC	AT	GA	MIL	TOTAL
0000	1	19	7	0	27	0	27	7	0	34
0100	1	13	5	0	19	1	16	8	0	25
0200	1	4	3	0	8	0	7	3	0	10
0300	0	18	5	0	23	0	25	6	0	31
0400	0	13	2	0	15	0	24	5	0	29
0500	0	7	1	0	8	1	10	1	0	12
0600	0	7	4	1	12	1	6	7	0	14
0700	11	5	16	0	32	12	6	27	0	45
0800	8	11	27	0	46	10	12	43	1	66
0900	9	8	35	2	54	9	9	64	1	83
1000	7	7	32	3	49	8	8	56	4	76
1100	9	5	33	5	52	9	6	55	3	73
1200	7	4	31	3	45	9	6	46	3	64
1300	9	4	36	4	53	8	5	40	4	57
1400	7	9	40	6	62	7	10	70	7	94
1500	10	5	47	2	64	12	6	67	6	91
1600	11	9	48	4	72	16	13	73	3	105
1700	10	9	39	2	60	11	13	61	3	88
1800	8	8	43	2	61	9	6	63	4	82
1900	6	7	21	8	42	6	9	42	14	71
2000	8	7	14	2	31	8	7	22	9	46
2100	9	5	12	3	29	9	8	22	6	45
2200	6	9	8	2	25	8	16	13	1	38
2300	4	9	7	0	20	3	13	10	1	27
TOTAL	142	202	516	49	909	157	268	811	70	1306

ROBERT MUELLER MUNICIPAL AIRPORT
AUSTIN, TEXAS

PRE-ARSA

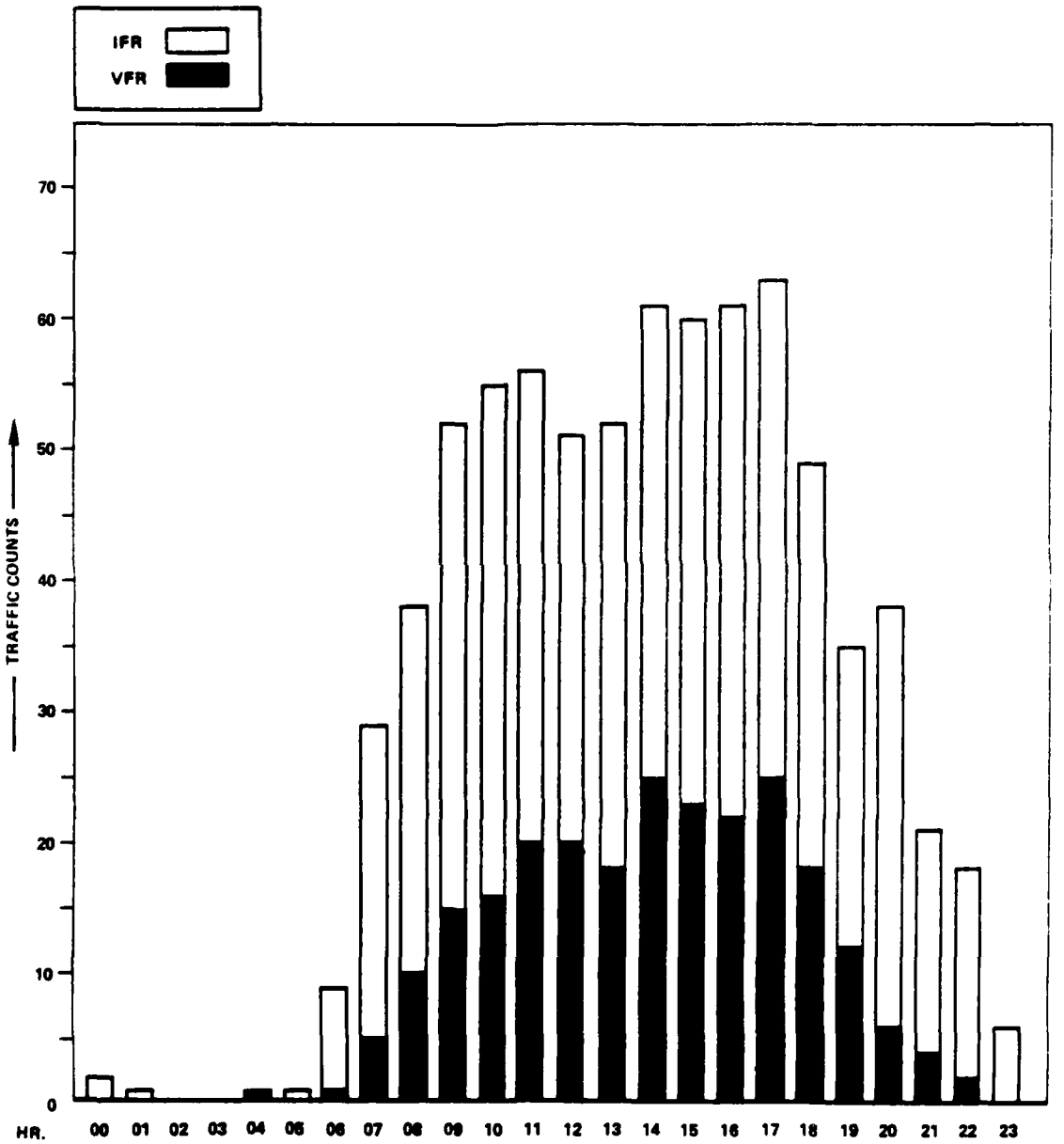


Figure 11A. Average Hourly TRACON Traffic Counts by Flight Type

ROBERT MUELLER MUNICIPAL AIRPORT
AUSTIN, TEXAS

POST-ARSA

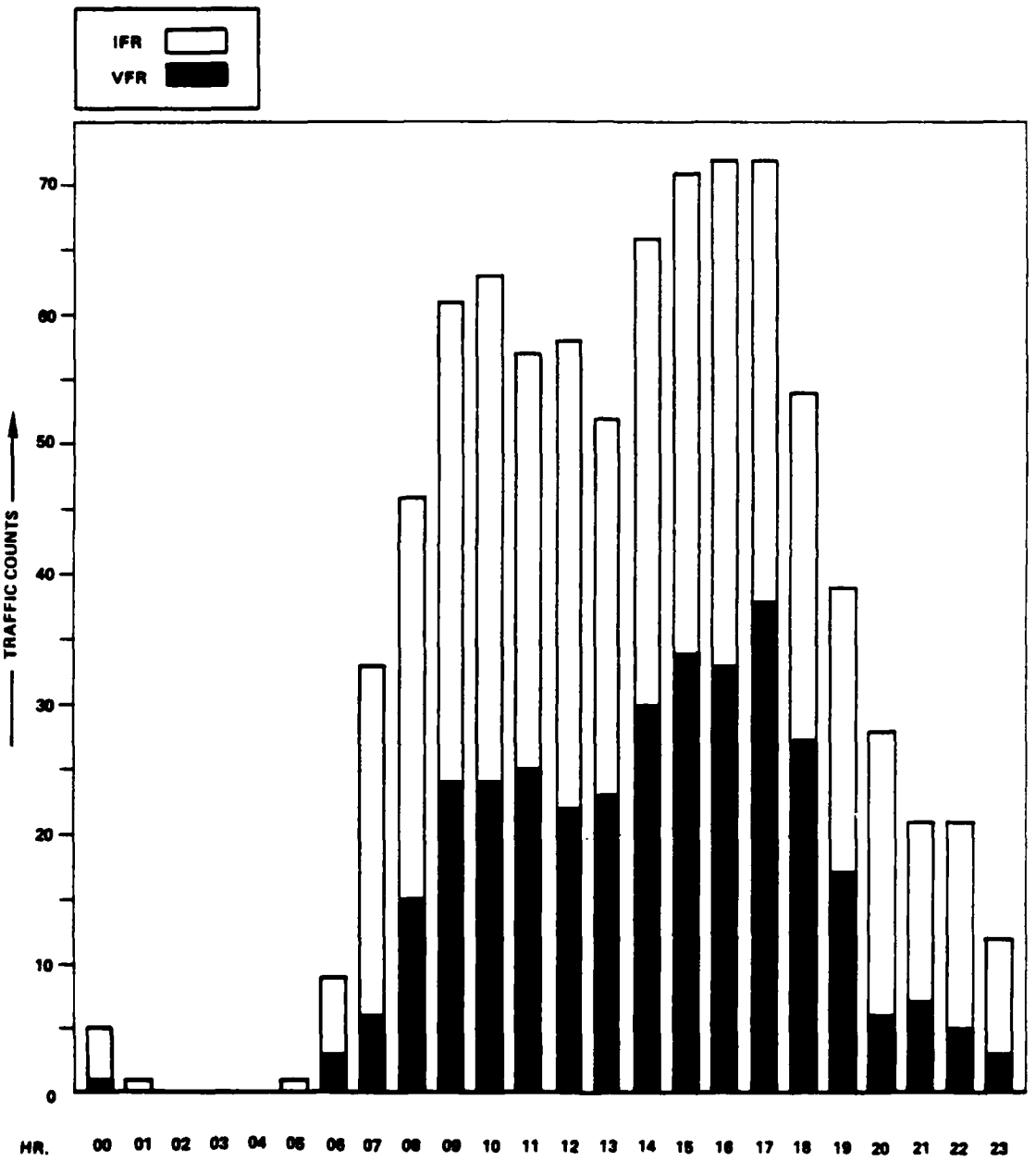


Figure 11B. Average Hourly TRACON Traffic Counts by Flight Type

PORT COLUMBUS INTERNATIONAL AIRPORT
COLUMBUS, OHIO

PRE-ARSA

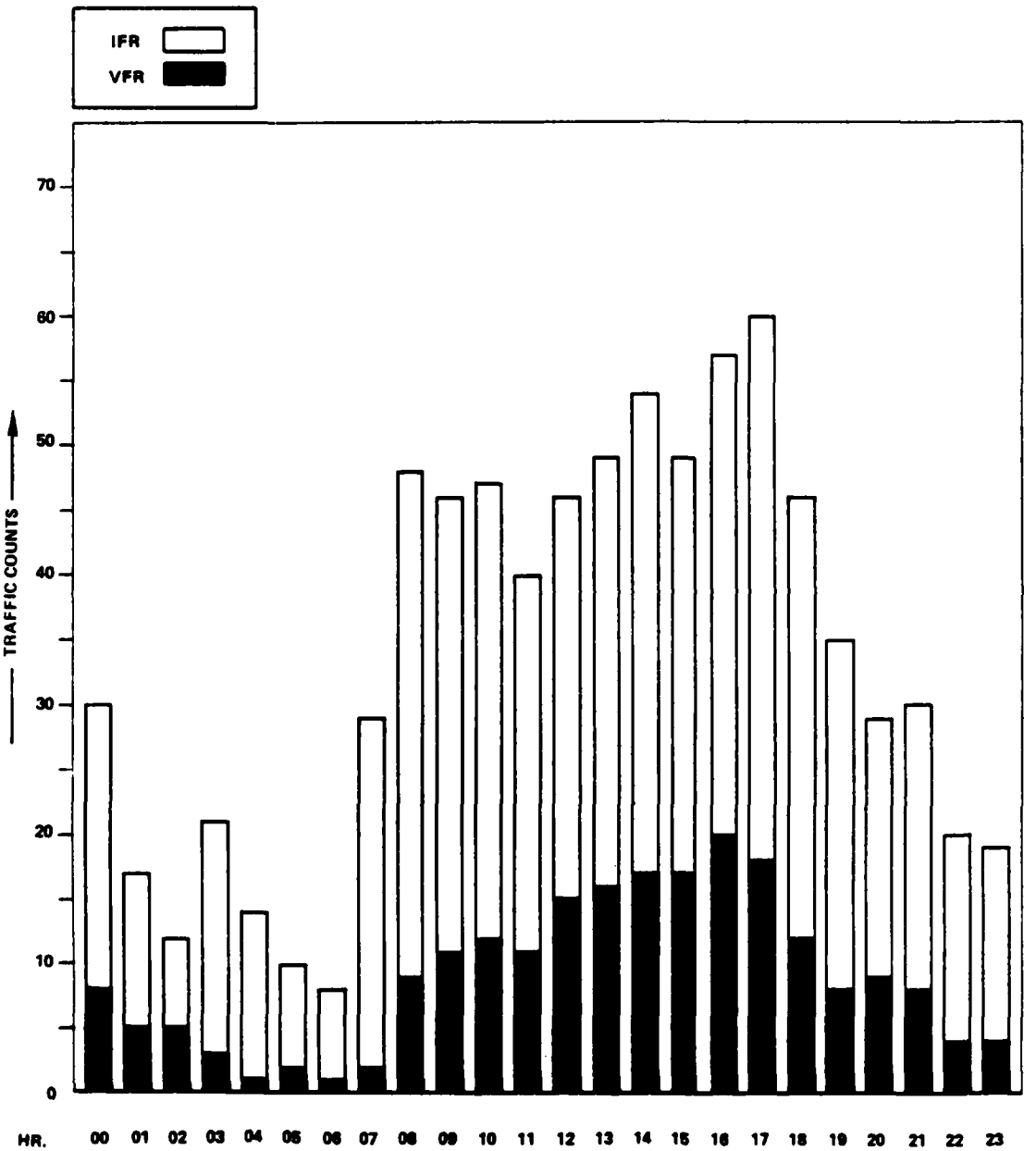


Figure 12A. Average Hourly TRACON Traffic Counts by Flight Type

PORT COLUMBUS INTERNATIONAL AIRPORT
COLUMBUS, OHIO

POST-ARSA

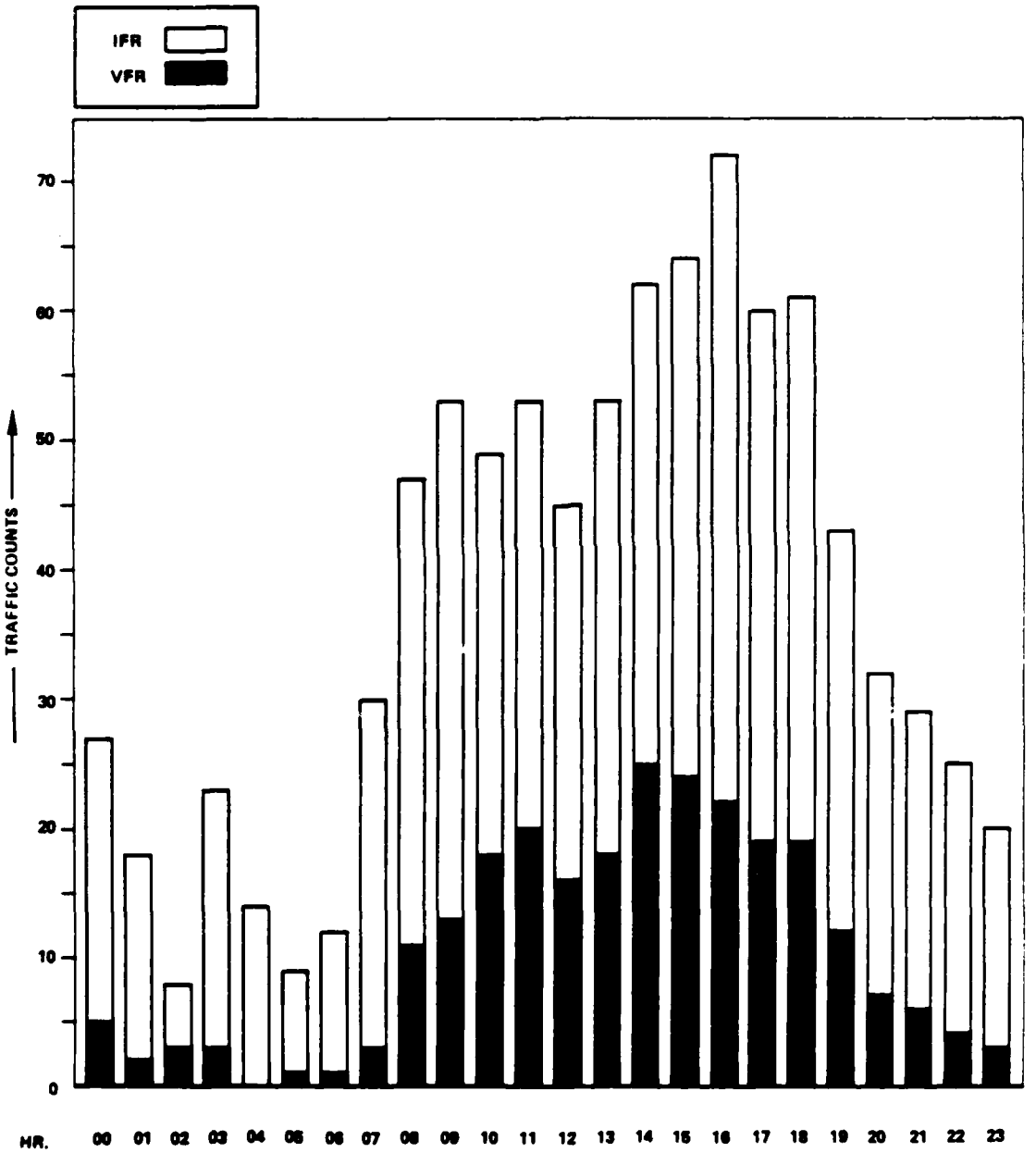


Figure 12B. Average Hourly TRACON Traffic Counts by Flight Type

ROBERT MUELLER MUNICIPAL AIRPORT
AUSTIN, TEXAS
PRE-ARSA

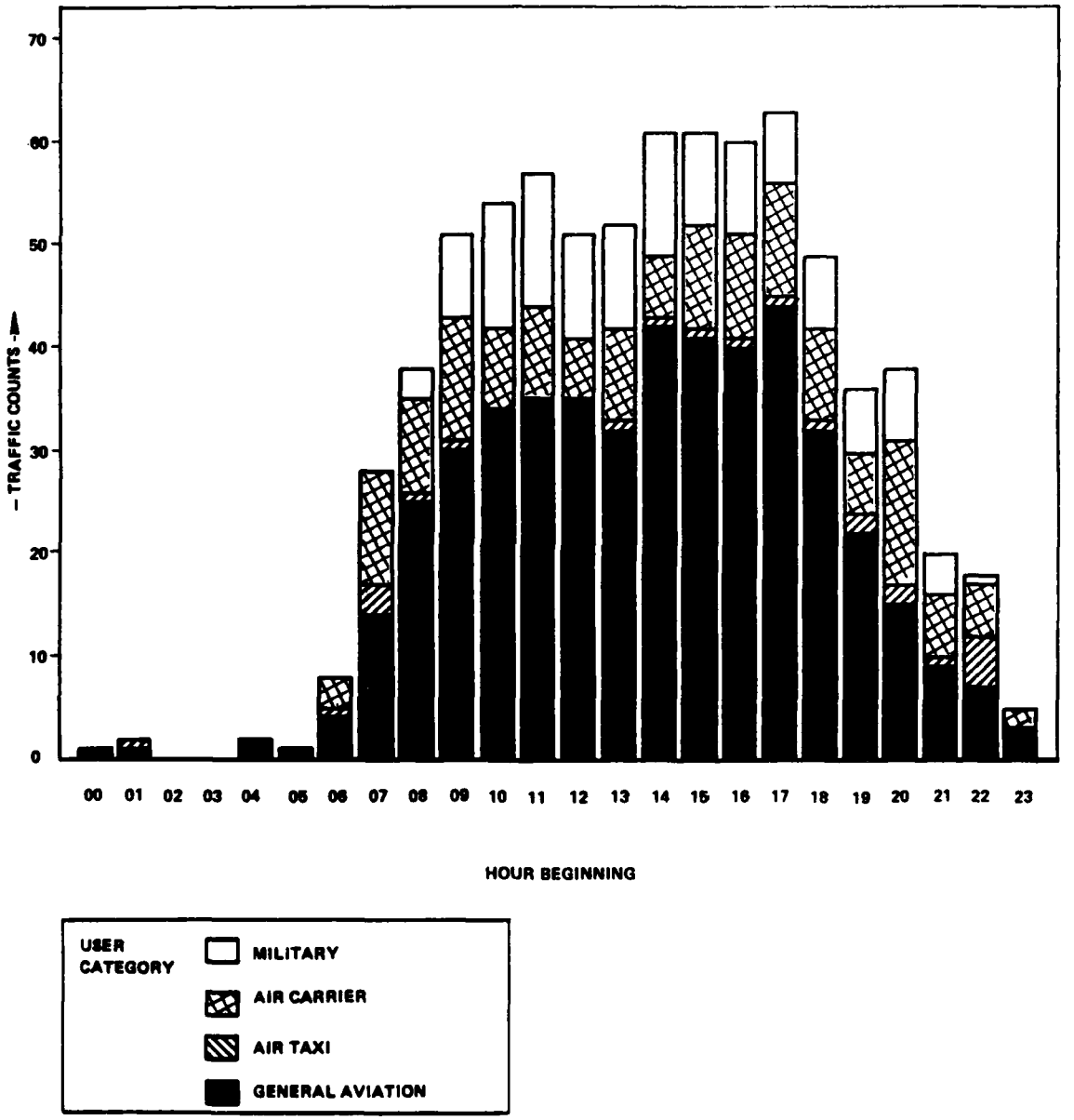


Figure 13A. Average Hourly TRACON Traffic Counts by User Category

ROBERT MUELLER MUNICIPAL AIRPORT
AUSTIN, TEXAS
POST-ARSA

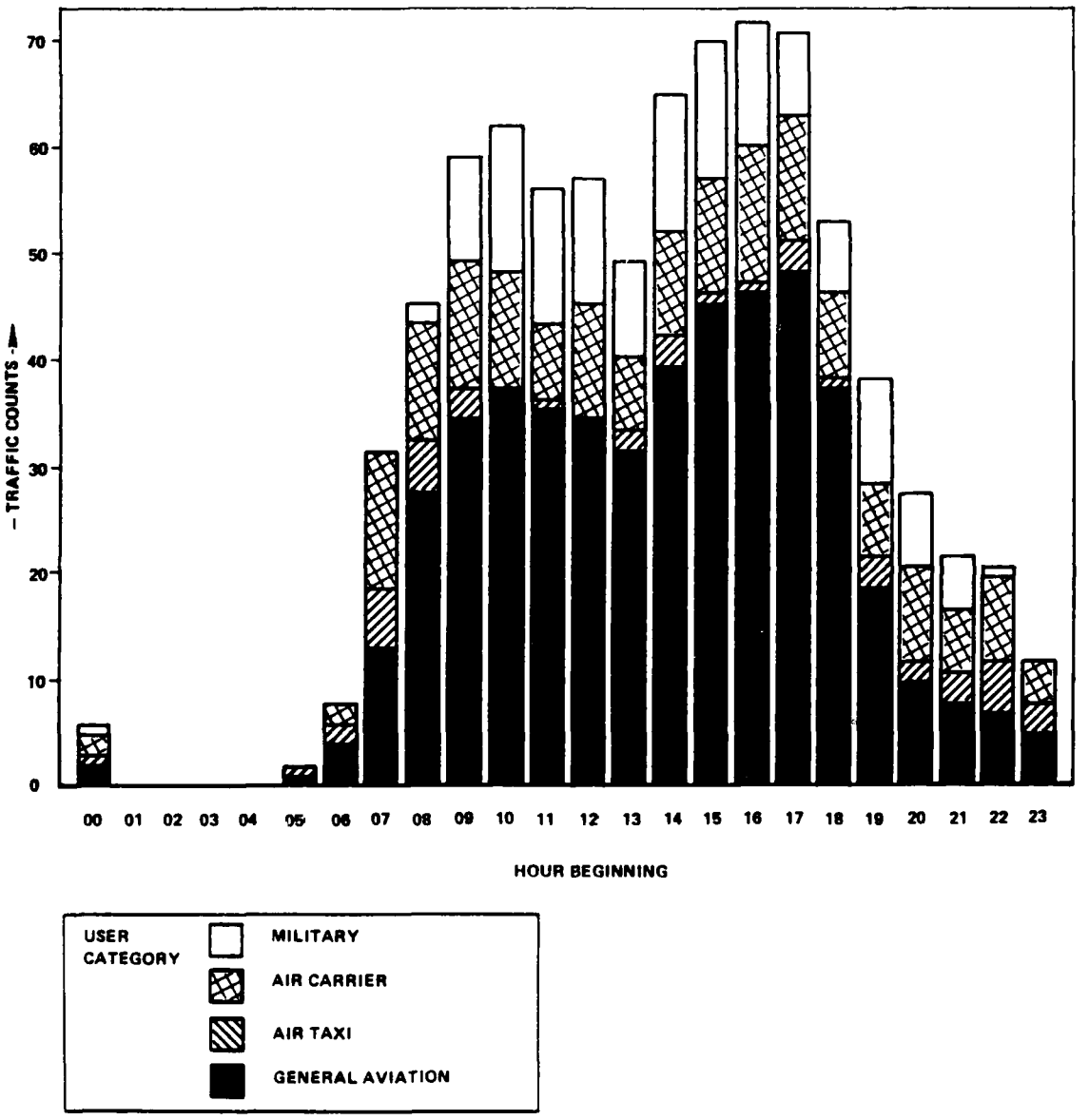


Figure 13B. Average Hourly TRACON Traffic Counts by User Category

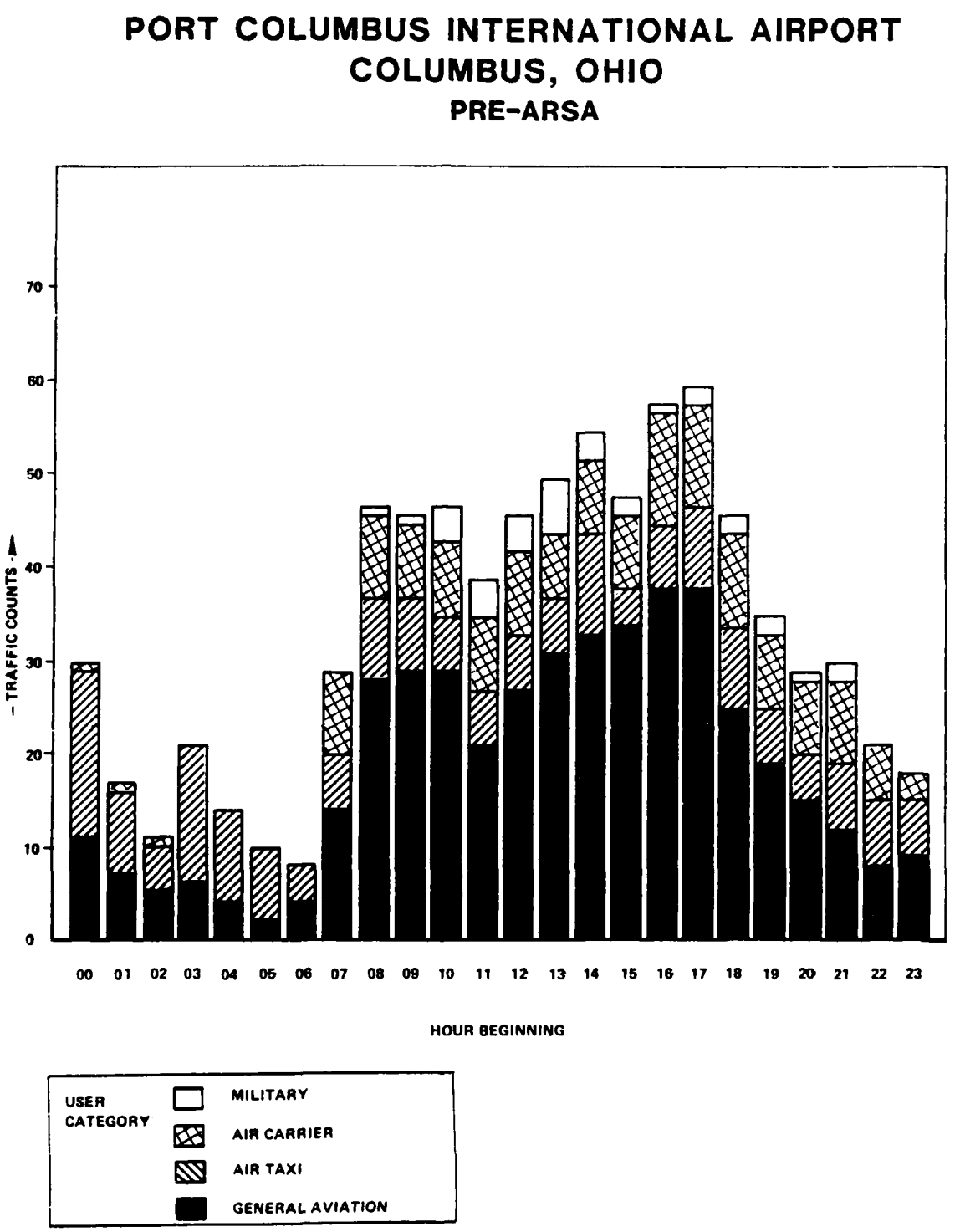


Figure 14A. Average Hourly TRACON Traffic Counts by User Category

PORT COLUMBUS INTERNATIONAL AIRPORT
COLUMBUS, OHIO
POST-ARSA

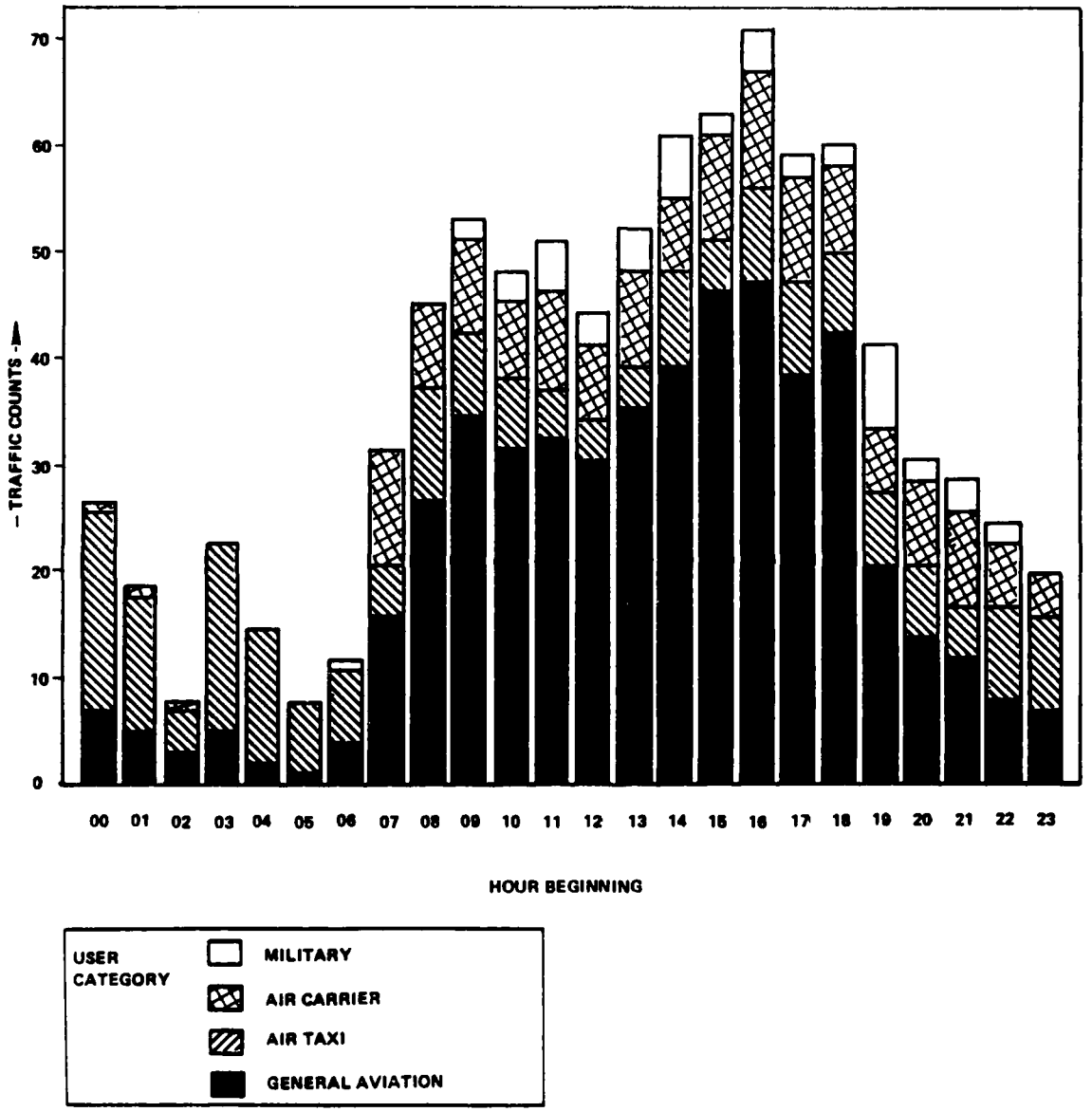
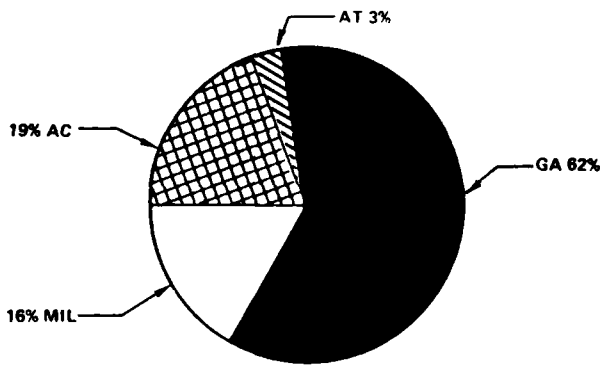
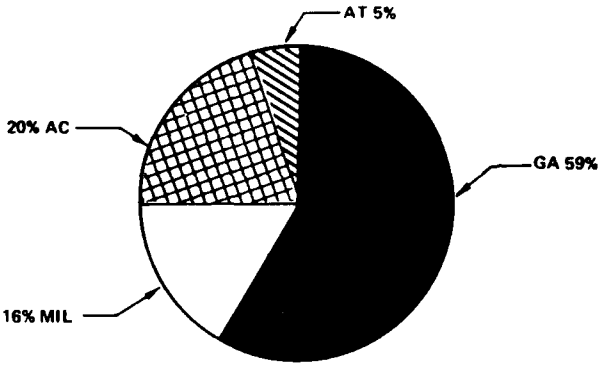


Figure 14B. Average Hourly TRACON Traffic Counts by User Category

ROBERT MUELLER MUNICIPAL AIRPORT
AUSTIN, TEXAS



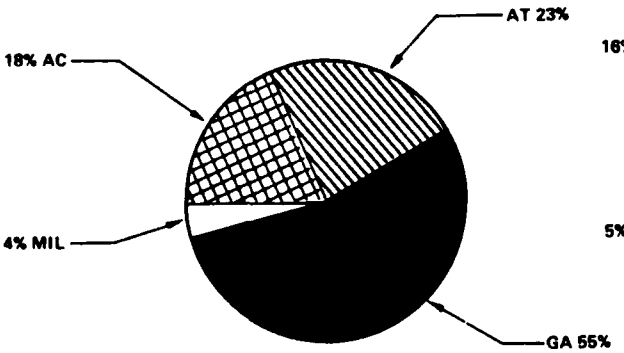
PRE-ARSA*



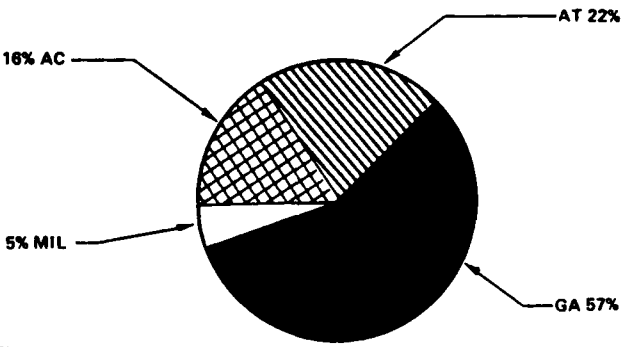
POST-ARSA

NOTE: AUSTIN FACILITY PROVIDED STAGE II VFR TRAFFIC DATA AS AN AGGREGATE AND NOT BY USER CATEGORY.

PORT COLUMBUS INTERNATIONAL AIRPORT
COLUMBUS, OHIO



PRE-ARSA



POST-ARSA

Figure 15. TRACON Traffic Mix Worked by the Controller

Austin, Texas	Columbus, Ohio
⩽ 2000′	⩽ 2200′
< 4600′	< 4800′
⩾ 4600′	⩾ 4800′

The total overflight traffic worked by TRACON for the 7 days during the pre- and post-ARSA periods is depicted below:

	Pre-ARSA		Post-ARSA	
	Total No. of Overflights	% of Total Traffic Counts	Total No. of Overflights	% of Total Traffic Counts
Robert Mueller Municipal Airport	505	9.5%	440	7.5%
Port Columbus International Airport	1131	19.7%	1206	18.9%

The percent of total traffic counts is computed as the ratio of the total overflight traffic worked by TRACON over the period of 7 days divided by the total traffic counts for those 7 days.

The altitude trends of this overflight traffic have been drawn up in Table 16 under the three selected altitude layers. The change is insignificant as only 3% of the overflight traffic seems to be flying higher over the duration of 7 days evaluated during the post-ARSA implementation period at both the confirmation sites.

3.3.2.4 Satellite/Secondary Airport Operations

The traffic counts for the satellite/secondary airports at both lead sites were also analyzed and the analysis shows that there has not been any significant change in traffic activity at the Ohio State University, Bolton or Bergstrom AFB airports during the post-ARSA periods as compared to the pre-ARSA period.

Table 16: Overflight Traffic – Altitude Trends

A. Robert Mueller Municipal Airport – Austin, Texas

ALTITUDES USED	PERCENT OF TOTAL OVERFLIGHT TRAFFIC WORKED BY TRACON		PERCENT CHANGE
	PRE-ARSA	POST-ARSA	
⩽2000'	14	12	-2
<4600'	15	14	-1
⩾4600'	71	74	+3

B. Port Columbus International Airport – Columbus, Ohio

ALTITUDES USED	PERCENT OF TOTAL OVERFLIGHT TRAFFIC WORKED BY TRACON		PERCENT CHANGE
	PRE-ARSA	POST-ARSA	
⩽2200'	23	16	-7
<4800'	33	37	+4
⩾4800'	44	47	+3

NOTE:

1. Numbers presented here are based on the Flight Progress Strip Data provided by each of the facilities.

2. Percentages are based on share of overflight traffic under defined altitude stratums of ARSA Core divided by the total overflight traffic worked by TRACON for the period under evaluation.

4.0 ARSA CONFIRMATION

The operational confirmation of the Airport Radar Service Area has been a success. This can be attributed to the fact that since implementation at the two lead sites, positive response to the ARSA has been received from users, controllers/staff and supervisors/management. In addition, there is no adverse effect on traffic activity. The criteria of the confirmation of the Airport Radar Service Area at both lead sites are provided in Section 4.1.

4.1 CONFIRMATION CRITERIA

The criteria which have been used to determine the operational confirmation of ARSA are provided as items 1, 2 and 3 below. These criteria support the NAR Task Group recommendations that are pertinent to the confirmation process.

Confirmation Criteria	NAR Task Group 1-2.2 Recommendations
1. Acceptance by the users	1-2.2.2; 1-2.2.3; 1-2.2.4; 1-2.2.8; 1-2.2.7
• Understanding of the concept and services provided in the ARSA core and outer limits area generated by the simplicity of ARSA shape and dimensions and consistency of services.	
• Perceived increase in safety	
• No significant change in flying pattern	
• Positive reaction towards participation in the ARSA	
2. Controller/Management acceptance:	1-2.2.1; 1-2.2.6
• No noticeable increase in delays	
• Perceived increase in safety	
• Increase in controller activity levels	
• Ease in administering ATC facilities	
• Support for national applicability	
3. Positive effect on Traffic Activity	

4.2 RESULTS

Survey results of local pilots, controllers and supervisor/management at both sites reveal that a majority of the respondents who participated in the survey understand the ARSA concept and the services offered; that ARSA depiction on FAA charts, frequency information, and ARSA shape and dimensions are acceptable; that there have been no additional perceived delays while operating under the new airspace rules; that user's participation has increased and that safety has been enhanced because all traffic is under control and because the new ATC environment is more efficient and effective due to standardized services and procedures.

Physical data analysis reveals that no discernible shifts in hourly traffic activity and changes in peaking characteristics have occured at either lead site. Additionally, there have been no changes in the mix of traffic (AC, AT, GA. and MIL) worked by controllers since the implementation of ARSA at the two sites.

An increase in the facility traffic counts for both sites has been documented. This increase is probably due to an increase in user participation required by the mandatory two-way radio communications requirement for operating in ARSA. It is important to note that although an increase in traffic has occured due to additional traffic being worked by the controllers, safety is perceived by users to have been increased and delays have not been reported as detrimental.

Based on the analysis results and the ARSA operational confirmation criteria, we conclude that ARSA has been confirmed at Columbus, Ohio and Austin, Texas.

APPENDIX A

NATIONAL AIRSPACE REVIEW RECOMMENDATIONS

ON THE AIRPORT RADAR SERVICE AREA

RECOMMENDATIONS

NAR 1-2.2.1

The Task Group recommends that the current Terminal Radar Service Area (TRSA) program - Airspace and Services - be discontinued. The Task Group further recommends that the concept identified herein as Model B Airspace and Services be implemented as a replacement for the TRSA program in accordance with the recommendations to follow.

NAR 1-2.2.2

The Task Group recommends that the physical dimensions of the Model B Airspace Core shall be a 10 NM radius capped at 4,000 feet height above airport (HAA) from the primary airport. This airspace shall extend down to 1,200 feet above the surface except that an inner core with a 5 nautical mile radius shall extend down to the surface. Except for aircraft departing from satellite airports/heliports within the Model B Airspace Core, all aircraft shall establish two-way radio communications with ATC prior to entering the airspace. Aircraft departing satellite airports/heliports within the surface area of the Model B Airspace Core shall establish two-way radio communications with ATC as soon as possible. Pilots must comply with approved FAA traffic patterns when departing these airports.

NAR 1-2.2.3

The Task Group recommends that the outer limit of Model B airspace be the same dimensions as the radar/radio coverage within each approach control's delegated airspace. While strongly encouraged, two-way radio communications are *not* a VFR requirement in the outer limits of Model B airspace and aircraft are not restricted from entering/transitting this airspace.

NAR 1-2.2.4

Services provided within the Model B Airspace Core shall be as follows: sequencing of arriving aircraft; IFR be provided standard IFR separation; IFR to VFR be provided traffic advisories and conflict resolution so that targets do not merge at the same altitude; and VFR to VFR be provided traffic advisories.

Furthermore, aircraft operating outside the Core but within the confines of the Outer Limits will receive Model B services upon establishing two-way radio communications and radar contact.

NAR 1-2.2.6

The Task Group recommends that, excluding TCA locations, all airports with an operational airport traffic control tower and currently contained within a TRSA serviced by a Level III, IV, or V radar approach control facility shall have Model B airspace designated; unless a study indicates that such designation is inappropriate for a particular location. Any other location serviced by a radar approach control facility may be considered as a candidate location for Model B airspace on the basis of a thorough staff study considering, but *not limited to* the following:

1. Traffic mix, flow, density, and volume

2. Airport configuration, geographical features and adjacent airspace/facilities

3. Collision risk assessment

4. ATC capabilities to provide Model B services to the users at maximum benefit and minimum cost

All proposed Model B airspace actions shall be subject to regional and Headquarters approval.* Any Model B location which fails to meet the establishing criteria for its respective location for more than 12 consecutive months, shall be subject to a regulatory review to terminate the Model B airspace designated.

*NOTE: Military-operated facilities will process requests through appropriate military and FAA channels.

NAR 1-2.2.7

The Task Group recommends for further consideration by Task Group 1-6 that all Model B Airspace Cores be charted, and that either a visual or narrative method of identifying the Outer Limits of Model B Airspace be undertaken.

NAR 1-2.2.8

The Task Group recommends the aviation community be made aware of Model B Airspace by educational programs to support ATC operational and procedural information, phraseology, practices, and the desirability of voluntary participation. Specifically, it is recommended:

1. All FAA pilot exams and appropriate testbooks must contain a significant amount of questions and information concerning radar operation in terminal areas. Specifically, operations and procedures be included in written and practical tests for pilot certification, ratings, and reviews.

2. Specific questions and answers must be required on all flight reviews and other appropriate occasions (air carrier initial and recurrent proficiency training, pilot proficiency exams, biennial flight review, etc.) to assure that users in every aviation community have shown a current understanding of radar terminal areas and their use of these areas.

3. The FAA develop and fund a traveling air traffic team to speak to pilot groups on operations within the National Airspace System; i.e., Model B airspace. Emphasis should be given to flight instructor contact.

4. An advisory circular dealing with Model B airspace be published to include well presented, up-to-date information on operations in terminal airspace and that this advisory circular be given the widest possible dissemination to aviation users and organizations.

5. The Airman's Information Manual (AIM) be distributed free of charge to all fixed base operators (FBO's) at all public use airports.

6. FAA Public Affairs Office develop and promote through the general news media, aviation awareness of FAA services and publications available to the pilot and general public.

7. Facts about terminal airspace in some form of questionnaire be developed and distributed by the FAA to appropriate agencies (licensed pilots, fixed base operators, business organizations, etc.). This questionnaire could be a public relations effort, advisory circular, or included in the Airman's Information Manual.

8. FAA continue to make available to interested pilot groups training or other audio-visual aids that deal with terminal radar operations.

APPENDIX B

ARSA USERS BRIEFING SITES

Austin

Date	Location	Attendance
November 1, 1983	Howard Aviation, Georgetown Airport	5
2	GT +3 San Marcos Airport	22
3	Ragsdale East, Robert Mueller Municipal	6
5	Texas Air National Guard	28
9	TIMS (Austin Executive) Airport	33
10	Department of Public Safety	34
19	Texas Air National Guard	25
December 1, 1983	Killeen Municipal Airport, Killeen TX	13
	TOTAL AUSTIN	166

*Meeting with Ultralight Pilots not included

Columbus

Date	Location	Attendance
November 15, 1983	Rickenbacker Air National Guard Base	24
17	Delaware Airport	2
17	Union County Airport	6
18	Ohio State University Airport	8*
21	Knox County Airport	2
22	Buckeye Executive Airport	1
29	Bolton Airport	4
30	Fayette County Airport	3
30	Ross County Airport	1
30	Pickaway County Airport	4
December 1, 1983	Fairfield County Airport	2
5, 6, 7, 8, 9	Port Columbus Tenant Briefings	14**
15	Battelle Auditorium	
19	General Aviation District Office	7***
20	FAA, Newark Ohio	
	TOTAL COLUMBUS	93

*Personnel from OSU Tower
1 person - Director of OSU Airport
2 - OSU flight training
**Attendees not adequately reported
***FAA GADO personnel

APPENDIX C

ASRS NEAR-MISS DATA FOR THE LEAD SITES

ASRS NEAR-MISS DATA COLUMBUS SITE 1978-1984

INCIDENT NUMBER	DATE OF OCCURRENCE	REPORTED BY	AIRCRAFT INVOLVED	REPORTER'S RECOMMENDATIONS	COMMENTS ON ARSA IMPACT
1	05/78	Pilot	3-All SMA	None	Yes. Aircraft would have been in contact with ATC and received traffic advisory.
2	06/78	Air Force	2-MTR, SMT	Local FSO and controller briefings. Keyword radar advisory service. Altitude heading rules enforced. Pilot vigilance.	No effect. Both Aircraft outside ARSA domain.
3	12/78	Air Force	2-FGT, SMA	Make pilots aware of the responsibility to see and avoid. Discuss safety at local flying meetings.	Probably not. Proper see-and-avoid procedures not applied.
4	04/79	Controller	3-All SMT	None	No impact. All aircraft under ATC.
5	05/79	Controller	2-MLG, SMA	None	Probably not. Possibility that ATC reported an erroneous aircraft position.
6*	07/79	Air Force	2-MTR, SMA	1. Brief aircrews on incident 2. Communicate with operations when tests being done. 3. All parties involved in letter of agreement concur in standard interpretation of procedures.	Probably not. This occurred because of confusion over exiting procedures from a training route.

*Reported by 3 separate Air Force personnel

ASRS NEAR-MISS DATA COLUMBUS SITE 1978-1984

INCIDENT NUMBER	DATE OF OCCURRENCE	REPORTED BY	AIRCRAFT INVOLVED	REPORTER'S RECOMMENDATIONS	COMMENTS ON ARSA IMPACT
7	09/79	Pilot	2-MLG, SMA	None	Yes. Two-way radio communication requirements of ARSA.
8	10/79	Air Force	2-MLT, SMA	Should emphasize the NMAC at Flight Safety Meetings.	No effect. Both aircraft outside ARSA domain.
9	11/79	Air Force	2-MLT, SMA	None	Yes. Aircraft in contact with ATC.
10	03/80	Air Force	2-MTR, UNK	None	Yes. Two-way radio communication requirements.
11	05/80	Controller	2-SMT, SMA	None	No effect. Poor see-and-avoid procedures, and failure of ATC to provide proper advisory procedures.
12	09/80	Air Force	2-MTR, SMA	Briefing on mishap. Emphasize formation positioning.	Yes. Two-way radio communication requirements.
13	10/80	Controller	2-MLT, SMT	None	No effect. All aircraft under ATC.
14	06/82	Pilot	2-LGE, SMT	Could reduce by avoidance collision system.	No effect. Above ARSA domain.
15	11/82	Air Force	2-BMB, SMA	Restrictions information letters sent to civilian military pilots.	No effect. Aircraft not using TRSA probably would not use ARSA.

ASRS NEAR-MISS DATA COLUMBUS SITE 1978-1984

INCIDENT NUMBER	DATE OF OCCURRENCE	REPORTED BY	AIRCRAFT INVOLVED	REPORTER'S RECOMMENDATIONS	COMMENTS ON ARSA IMPACT
1	11/78	Pilot	3-SMA, SMA, FGT	None	Yes. ARSA conflict resolution probably would have prevented incident.
2	12/78	Controller	2-SMA, SMT	None	No effect. Both aircraft outside ARSA domain.
3	02/79	Air Force	2-FGT, SMA	Briefings on incident. Inform pilots of NMAC program. Alter approaches to certain runways.	Yes. ARSA would require aircraft to contact ATC and prevent incident.
4	04/79	Pilot	2-LGT, SMA	Have tower verify that departure corridors are clear. TCA's the best answer.	Yes, because of the mandatory requirement to contact ATC while operating in ARSA airspace.
5	05/79	Air Force	2-MTR, SMT	None	Yes. ARSA would require aircraft to contact ATC and maintain two-way radio communications.
6	06/79	Controller	2-LGT, SMA	None	No effect. Voluntary participation area.
7	06/79	Air Force	2-FGT, SMA	Reminders to pilots to contact ATC when going through control.	Yes. ARSA would require aircraft to contact ATC.
8	09/79	Pilot	2-LGT, SMT	Controllers should give more attention to IFR/VFR mix flow.	No. Both aircraft outside ARSA domain.

ASRS NEAR-MISS DATA COLUMBUS SITE 1978-1984

INCIDENT NUMBER	DATE OF OCCURRENCE	REPORTED BY	AIRCRAFT INVOLVED	REPORTER'S RECOMMENDATIONS	COMMENTS ON ARSA IMPACT
9	11/79	Pilot	4-All SMA	None	No effect. Below ARSA in VFR pattern.
10	11/79	Pilot	4-All SMA	None	No effect. Below ARSA in VFR pattern.
11	04/80	Air Force	2-MLT, SMA	See and avoid issues a priority in aircrew meetings. Emphasis to civilians on use of ATC services.	Yes. Aircraft B would have been required to contact ATC while in the ARSA.
12	07/80	Air Force	2-MLT, UKN	Educate users. Stress importance of ATC service usage.	No effect. No difference between TRSA/ARSA.
13	07/80	Pilot	2-Both SMT	Controllers follow approved procedures more closely and stricter adherence to FAA required VFR flight procedures.	No effect. Both aircraft under control of ATC.
14	09/80	Pilot	2-LG, SMA	None	Yes. ARSA would probably prevent. Unidentified aircraft would be in contact with ATC.
15	10/80	Pilot	2-MLG, SMA	None	Probably not. Both aircraft outside ARSA domain. Both aircraft in contact with ATC.

ASRS NEAR-MISS DATA AUSTIN SITE 1978-1984

INCIDENT NUMBER	DATE OF OCCURRENCE	REPORTED BY	AIRCRAFT INVOLVED	REPORTER'S RECOMMENDATIONS	COMMENTS ON ARSA IMPACT
16	10/80	Controller	2-SMA, SMA	None	Yes. The small aircraft would have been required to establish and maintain two-way radio contact while in ARSA.
17	02/81	Controller	2-Both SMA	None	No effect. Both aircraft under ATC.
18	04/81	Air Force	2-Fighter, SMT	Remind crewman that good visual lookout pattern essential. Continue to emphasize see the avoid.	No effect. Both aircraft outside ARSA domain.
19	05/82	Controller	2-SMA, SMT	None	No impact. All aircraft under ATC.
20	06/82	Air Force	2-FGT, SMA	Emphasize critical need for visual lookout when VMC.	Yes. Because of the requirement to maintain two-way radio communications.
21	10/82	Pilot	2-LGT, SMT	None	No effect. All aircraft under ATC.
22	02/83	Air Force	2-FGT, SMA	Remind pilots that controllers cannot guarantee separation between VFR aircraft not under their control.	Yes, because of two-way radio requirements, and the services which are provided by ATC in ARSA.
23	06/83	Pilot	2-SMT, SMA	None	Yes. ARSA would probably prevent. All aircraft would be provided conflict resolution.

ASRS NEAR-MISS DATA AUSTIN SITE 1978-1984

INCIDENT NUMBER	DATE OF OCCURRENCE	REPORTED BY	AIRCRAFT INVOLVED	REPORTER'S RECOMMENDATIONS	COMMENTS ON ARSA IMPACT
24	06/83	Pilot	2-LGT, SMA	None	No. Both aircraft outside ARSA domain.
25	03/84	Pilot	2-LGT, SMA	None	No. Both aircraft outside ARSA domain.
26	03/84	Pilot	2-MLG, SMT	None	Probably not. Aircraft outside ARSA domain.
27	04/84	Pilot	2-LGT, SMA	None	No. These aircraft were under ATC control.
28	04/84	Crewman	2-LGT, SMA	None	No. These aircraft were under ATC control.
29	04/84	Controller	2-SMT, SMA	None	No. These aircraft were under ATC control.

APPENDIX D

ARSA OPERATIONAL CONFIRMATION SURVEY

QUESTIONNAIRES OF PILOTS, CONTROLLERS AND

SUPERVISOR/MANAGEMENT STAFF

Form Approved OMB No. 2120-0510

AIRPORT RADAR SERVICE AREA (ARSA) OPERATIONAL CONFIRMATION

PILOT QUESTIONNAIRE

Two sites (Columbus, Ohio and Austin, Texas) are being used for an operational confirmation of the Airport Radar Service Areas (ARSA). The FAA is interested in user response to the new design and because each pilot cannot be questioned, your information is very valuable.

We've designed this survey to be simple and quick so that everyone will respond. Some questions are designed to determine what segment of the flying public you represent. Questions 11-17 are statements about specific ARSA issues and ask for a subjective response.

Should you have any questions about the survey, or desire to make further comments, please contact Mr. Jim Clark, (202) 426-3560

1) Check all appropriate Certificates and Ratings Attained.

- ☐ Student
- ☐ Private
- ☐ Commercial
- ☐ Air Transport
- ☐ Flight Instructor
- ☐ Single Engine
- ☐ Multi-engine
- ☐ Instrument
- ☐ Rotorcraft
- ☐ Other _____

2) Type Aircraft/Vehicle Flown:

- ☐ Single Engine Piston
- ☐ Multi-engine Piston
- ☐ Turbo prop
- ☐ Jet
- ☐ Rotorcraft
- ☐ Ultra light or glider
- ☐ Other _____

3) Flight Type:

- ☐ Personal (including Practice)
- ☐ Business
- ☐ Instruction
- ☐ Military
- ☐ Executive/Corporate
- ☐ On demand Air Taxi
- ☐ Air Carrier
- ☐ Other _____

4) Avionics Equipment:

- ☐ Two-way Radio
- ☐ Transponder
- ☐ DME
- ☐ Altitude Encoder (Mode C)
- ☐ VOR Receiver

5) Aircraft flown is based at _____

6) Where did you learn of the services provided in the ARSA?

- ☐ FAA Public meeting
- ☐ FAA Publications
- ☐ Letter to Airmen
- ☐ Private Publications Which _____
- ☐ User Group Name of organization _____
- Other (please specify) _____

7) Check the number of times flew within the ARSA (5 and 10 nm radius) in the following months considering both arrivals and departures as separate flights.

DEC	JAN	FEB	MAR	APR
☐ None	☐ None	☐ None	☐ None	☐ None
☐ 1-10	☐ 1-10	☐ 1-10	☐ 1-10	☐ 1-10
☐ 11-30	☐ 11-30	☐ 11-30	☐ 11-30	☐ 11-30
☐ 31-50	☐ 31-50	☐ 31-50	☐ 31-50	☐ 31-50
☐ over 50	☐ over 50	☐ over 50	☐ over 50	☐ over 50

8) Were most of your flights? ☐ IFR ☐ VFR

9) Were most of your flights?

☐ to/from primary airport ☐ overflight/bypass primary airport

10) Did you have to purchase a two-way radio in order to operate in the ARSA?

☐ Yes (Total cost installed $ _____) ☐ No

11) How did the ARSA implementation impact your flying?

- ☐ no change
- ☐ increased radio contacts with ATC
- ☐ altered altitude to avoid ARSA
- ☐ altered route of flight to avoid ARSA
- ☐ other (Explain under Remarks)

Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
12) Generally understand the services available within the ARSA.	☐	☐	☐	☐	☐
13) Safety is enhanced due to participation of all aircraft within the ARSA.	☐	☐	☐	☐	☐
14) Given similar flight situations, the service provided to you by ATC was consistent.	☐	☐	☐	☐	☐
15) The two-way radio communication requirements within the ARSA are acceptable.	☐	☐	☐	☐	☐
16) The shape of the ARSA is acceptable.	☐	☐	☐	☐	☐
17) The dimensions of the ARSA are acceptable.	☐	☐	☐	☐	☐
18) ARSA depiction on FAA charts is acceptable.	☐	☐	☐	☐	☐
19) ARSA frequency information on FAA charts is acceptable.	☐	☐	☐	☐	☐
20) Reaction to participating in the ARSA is positive.	☐	☐	☐	☐	☐

21) Remarks — Please use the back of this page to enter your opinion of ARSA considering participation, uniformity and extent of services presented.

Thank you for your time and effort spent filling out this questionnaire. Please mail this postage paid questionnaire at your earliest convenience.

Prior to June 30, 1994.

FAA FORM 7460-OT (5-84) (Use expires 12/31/84)

AIRPORT RADAR SERVICE AREA (ARSA) OPERATIONAL CONFIRMATION CONTROLLER QUESTIONNAIRE

Two sites (Columbus, Ohio and Austin, Texas) are being used for an operational confirmation of the Airport Radar Service Areas (ARSAs). The FAA is interested in your response to the new design: therefore, your information is very valuable.

1. Check your appropriate work areas and please indicate your qualifications.

WORK AREA		QUALIFICATIONS	
[ ]	Radar	[ ]	Trainee
[ ]	Tower	[ ]	Qualified on some positions
[ ]	Radar and Tower	[ ]	Fully qualified Radar Controller
		[ ]	Fully qualified Tower Controller
		[ ]	Fully qualified Radar and Tower Controller

2. Check your appropriate type and length of ATC experience.

TYPE		LENGTH	
[ ]	FAA	[ ]	1 to 5 years
[ ]	Military	[ ]	5 to 10 years
[ ]	Other	[ ]	More than 10 years

Specify _____

3. Pilots generally understand the services available within the ARSA.

[ ] Strongly Agree
[ ] Agree
[ ] Indifferent
[ ] Disagree
[ ] Strongly Disagree

4. Controllers are aware of the positions, altitudes, and intents of all aircraft within the ARSA.

[ ] Strongly Agree
[ ] Agree
[ ] Indifferent
[ ] Disagree
[ ] Strongly Disagree

5. Safety is enhanced because of participation of all aircraft within the ARSA boundary.

[ ] Strongly Agree
[ ] Agree
[ ] Indifferent
[ ] Disagree
[ ] Strongly Disagree

6. Controllers received sufficient training about ARSA prior to ARSA implementation.

[ ] Strongly Agree
[ ] Agree
[ ] Indifferent
[ ] Disagree
[ ] Strongly Disagree

7. Pilots understand the size and shape of ARSA.

[ ] Strongly Agree
[ ] Agree
[ ] Indifferent
[ ] Disagree
[ ] Strongly Disagree

8. ATC is receiving pilot participation in ARSA.

[ ] Strongly Agree
[ ] Agree
[ ] Indifferent
[ ] Disagree
[ ] Strongly Disagree

9. Pilot participation in ATC services is higher in ARSA than what it was prior to ARSA implementation.

[ ] Strongly Agree
[ ] Agree
[ ] Indifferent
[ ] Disagree
[ ] Strongly Disagree

10. ATC procedures are simpler to implement under ARSA.

[ ] Strongly Agree
[ ] Agree
[ ] Indifferent
[ ] Disagree
[ ] Strongly Disagree

If you disagree or strongly disagree with the question above, please check one of the following:

[ ] The same difficulty as pre-ARSA
[ ] More difficult than pre-ARSA

11. Average time communicating with each pilot under ARSA is about the same as before ARSA was implemented.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

If you disagree or strongly disagree with the questions above, please check one of the following:

[ ] Average time communicating with each pilot is longer than pre-ARSA

[ ] Average time communicating with each pilot is shorter than pre-ARSA

12. There are no increased delays as a result of ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

13. Controller workload under ARSA is about the same as before ARSA was implemented.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

If you disagree or strongly disagree with the question above, please check one of the following:

[ ] Perceived increase, percentage increase _____

[ ] Perceived decrease, percentage decrease _____

14. Pilots generally have a positive reaction to participating in the ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

OPEN QUESTION:

As a controller, do you have any additional comments concerning the implementation of ARSA regarding:

training/simplicity/communication/participation/workload/etc.?

Thank you for your time and effort spent filling out this questionnaire. Please mail this postage paid questionnaire at your earliest convenience.

(Prior to June 30 , 1984.)

AIRPORT RADAR SERVICE AREA (ARSA) OPERATIONAL CONFIRMATION SUPERVISOR/MANAGEMENT QUESTIONNAIRE

Two sites (Columbus, Ohio and Austin, Texas) are being used for an operational confirmation of the Airport Radar Service Areas (ARSAs). The FAA is interested in your response to the new design; therefore, your information is very valuable.

1. Please indicate type and level of facility.

TYPE		LEVEL	
[ ]	FAA	[ ]	Level III
[ ]	Military	[ ]	Level IV
[ ]	Civil	[ ]	RAPCON
		[ ]	Tower only

Currently a Supervisor/Manager at _____.

2. Overall controller workload since implementation of ARSA is about the same as before ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

3. There have been very few complaints about ARSA from the Controller staff.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

4. There have been very few complaints about ARSA from the flying public.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

If you disagree or strongly disagree with the above question, please indicate the main area of complaints from the flying public.

[ ] ATC services

[ ] Delays

[ ] Shape/Dimension of ARSA

[ ] ARSA depiction/frequency on FAA charts

[ ] Others, please explain _____

_____

5. Safety is enhanced by ARSA.

[ ] Strongly agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

6. Pilots generally understand the services available within ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

7. Commanders of adjacent military airports have registered fewer complaints about ATC services since ARSA implementation.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

8. Since the implementation of ARSA, administration of the facility has been the same as pre-ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

If you disagree or strongly disagree with the question above, please complete the following question.

Since the implementation of ARSA, has administration been easier or more difficult?

[ ] Easier

[ ] More difficult

9. ARSA operations at this facility should be continued indefinitely.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

10. ARSA should be implemented nationally at all present TRSA locations.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

11. ATC coordination between controllers at primary airports and secondary airports has not increased since ARSA implementation.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

If you disagree or strongly disagree, please complete the following statement:

[ ] Coordination has increased; percentage increase _____

12. Overall, the acceptance of ARSA by pilots has been favorable.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

13. Overall, the acceptance of ARSA by controllers has been favorable.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

14. Overall, the acceptance of ARSA by management has been favorable.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

OPEN QUESTION:

Do you have any additional comments concerning the administration of ARSA?

Thank you for your time and effort spent filling out this questionnaire. Please mail this postage paid questionnaire at your earliest convenience.

(Prior to June 30, 1984.)

APPENDIX E

LOCAL PILOTS RESPONSE DATA

1) Check all appropriate Certificates and Ratings Attained.

☐ Student	☐ Single Engine
☐ Private	☐ Multi-engine
☐ Commercial	☐ Instrument
☐ Air Transport	☐ Rotorcraft
☐ Flight Instructor	☐ Other_____

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STUDENT	56	56	9.842	9.842
PRIVATE	257	313	45.167	55.009
COMMERCIAL	177	490	31.107	86.116
AIR TRANSPORT	66	556	11.599	97.715
NO ANSWER	13	569	2.285	100.000

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
INSTRUCTOR	100	100	17.575	17.575
NOT A INSTRUCTOR	469	569	82.425	100.000

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
SINGLE ENGINE	210	210	36.907	36.907
SINGLE & MULTI	172	382	30.228	67.135
ROTORCRAFT	30	412	5.272	72.408
OTHER	1	413	0.176	72.583
SINGLE MULTI ROT	21	434	3.691	76.274
NO RATINGS	135	569	23.726	100.000

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
INSTRUMENT RATIN	241	241	42.355	42.355
NOT INSTRU RATIN	328	569	57.645	100.000

FREQUENCY represents the total number of responses to the various choices for each question.

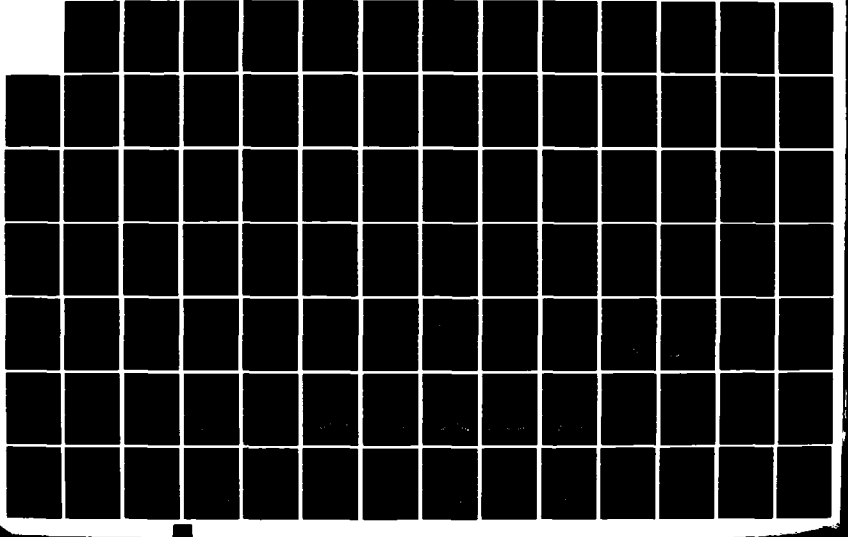
CUMULATIVE FREQUENCY, labeled *CUM FREQ*, represents the accumulative total of the frequency column, e.g., in Question 1, if 56 student pilots are added to 257 private pilots, the total equals 313. Then by adding 177 commercial pilots, the cumulative frequency would equal 490, etc.

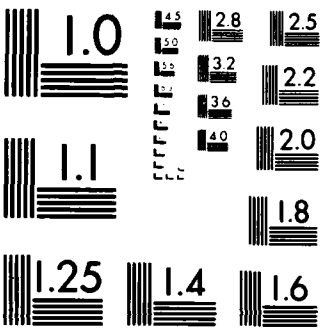
PERCENTAGES, labeled *PERCENT*, is derived by figuring the number of responses as a percentage of the total respondents.

CUMULATIVE PERCENTAGES, labeled *CUM PERCENT*, is the accumulative total of the percent column.

AD-A150 008 NATIONAL AIRSPACE REVIEW AIRPORT RADAR SERVICE AREA OPERATIONAL CONFIRMAT..(U) ENGINEERING AND ECONOMICS RESEARCH INC VIENNA VA M ROLLS ET AL. OCT 84 2/3

UNCLASSIFIED DOT/FAA/AT-84/2 DTFA01-82-Y-30562 F/G 1/5 NL





2) Type Aircraft/Vehicle Flown:

- ☐ Single Engine, Piston
- ☐ Multi-engine, Piston
- ☐ Turbo prop
- ☐ Jet
- ☐ Rotorcraft
- ☐ Ultra light or glider
- ☐ Other_____

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
SINGLE ENGINE	358	358	62.917	62.917
MULTI ENGINE	20	378	3.515	66.432
TURBO PROP	9	387	1.582	68.014
JET	20	407	3.515	71.529
ROTORCRAFT	41	448	7.206	78.735
ULTRALIGHT/GLIDE	4	452	0.703	79.438
ALL THE ABOVE	2	454	0.351	79.789
SINGLE AND MULTI	61	515	10.721	90.510
TURBO AND JET	7	522	1.230	91.740
TURBO SINGLE MULTI	26	548	4.569	96.309
SIN MULT JET TURBO	19	567	3.339	99.649
NO ANSWER	2	569	0.351	100.000

3) Flight Type:

- ☐ Personal (including Practice)
- ☐ Business
- ☐ Instruction
- ☐ Military
- ☐ Executive/Corporate
- ☐ On demand Air Taxi
- ☐ Air Carrier
- ☐ Other_____

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
PERSONAL	234	234	41.125	41.125
BUSINESS	57	291	10.018	51.142
INSTRUCTION	22	313	3.866	55.009
MILITARY	3	316	0.527	55.536
EXECUTIVE/CORPOR	18	334	3.163	58.699
AIR TAXI	7	341	1.230	59.930
AIR CARRIER	10	351	1.757	61.687
OTHER	4	355	0.703	62.390
PERSONAL INSTRUC	122	477	21.441	83.831
BUSI EXEC CORP	16	493	2.812	86.643
MILI BUSI PRIV	53	546	9.315	95.958
MILI & AIR CARRI	7	553	1.230	97.188
INSTRUC & BUSINE	13	566	2.285	99.473
NO ANSWER	3	569	0.527	100.000

4) Avionics Equipment:

☐ Two-way Radio ☐ DME
☐ Transponder ☐ Altitude Encoder (Mode C)
☐ VOR Receiver

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
TWO WAY RADIO	26	26	4.569	4.569
TRANSPONDER	1	27	0.176	4.745
RADIO & TRANSPON	33	60	5.800	10.545
RADIO TRANSPO VOR	132	192	23.199	33.743
ALL FIVE CHOICES	307	499	53.954	87.698
ALL BUT ENCODER	56	555	9.842	97.540
NO ANSWER	14	569	2.460	100.000

5) Aircraft flown is based at _____

AIRPORT	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NOANS*	49	43	7.557	7.557
OTHER	251	294	44.112	51.670
PRIME	135	429	23.726	75.395
SATEL	101	530	17.750	93.146
SECON	39	569	6.854	100.000

NOANS* = No Answer

6) Where did you learn of the services provided in the ARSA?

☐ FAA Public meeting
☐ FAA Publications
☐ Letter to Airmen
☐ Private Publications. Which _____
☐ User Group. Name of organization _____
Other (*please specify*) _____

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
FAA MEETINGS	30	30	5.272	5.272
FAA PUBLICATION	316	346	55.536	60.808
LETTER TO AIRMEN	24	370	4.218	65.026
PUBLICATION & LETTER	20	390	3.515	68.541
PRIVATE PUBLICATION	62	452	10.896	79.438
USER GROUP	57	509	10.018	89.455
OTHER	27	536	4.745	94.200
NO ANSWER	33	569	5.800	100.000

7) Check the number of times flow within the ARSA (5 and 10 nm radius) in the following months considering both arrivals and departures as separate flights.

DEC	JAN	FEB	MAR	APR
☐ None	☐ None	☐ None	☐ None	☐ None
☐ 1-10	☐ 1-10	☐ 1-10	☐ 1-10	☐ 1-10
☐ 11-30	☐ 11-30	☐ 11-30	☐ 11-30	☐ 11-30
☐ 31-50	☐ 31-50	☐ 31-50	☐ 31-50	☐ 31-50
☐ over 50	☐ over 50	☐ over 50	☐ over 50	☐ over 50

DEC	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NONE	246	246	43.234	43.234
1 TO 10	223	469	39.192	82.425
11 TO 30	55	524	9.666	92.091
31 TO 50	9	533	1.582	93.673
OVER 50	7	540	1.230	94.903
NO ANSWER	29	569	5.097	100.000

JAN	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NONE	222	222	39.016	39.016
1 TO 10	235	457	41.301	80.316
11 TO 30	63	520	11.072	91.388
31 TO 50	9	529	1.582	92.970
OVER 50	8	537	1.406	94.376
NO ANSWER	32	569	5.624	100.000

FEB	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NONE	216	216	37.961	37.961
1 TO 10	238	454	41.828	79.789
11 TO 30	66	520	11.599	91.388
31 TO 50	11	531	1.933	93.322
OVER 50	8	539	1.406	94.728
NO ANSWER	30	569	5.272	100.000

MARCH	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NONE	200	200	35.149	35.149
1 TO 10	238	438	41.828	76.977
11 TO 30	76	514	13.357	90.334
31 TO 50	12	526	2.109	92.443
OVER 50	12	538	2.109	94.552
NO ANSWER	31	569	5.448	100.000

APRIL	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NONE	187	187	32.865	32.865
1 TO 10	245	432	43.058	75.923
11 TO 30	80	512	14.060	89.982
31 TO 50	17	529	2.988	92.970
OVER 50	10	539	1.757	94.728
NO ANSWER	30	569	5.272	100.000

8) Were most of your flights? ☐ IFR ☐ VFR

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
BOTH	13	13	2.285	2.285
IFR	106	119	18.629	20.914
VFR	417	536	73.286	94.200
NO ANSWER	33	569	5.800	100.000

9) Were most of your flights?

☐ to/from primary airport ☐ overflight/bypass primary airport

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
TO/FROM PRIMARY	299	299	52.548	52.548
BYPASS	216	515	37.961	90.510
BOTH	10	525	1.757	92.267
NO ANSWER	44	569	7.733	100.000

10) Did you have to purchase a two-way radio in order to operate in the ARSA?

☐ Yes (Total cost installed $_____). ☐ No

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
	2			
NO	532	532	93.827	93.827
YES	8	540	1.411	95.238
NO ANSWER	27	567	4.762	100.000

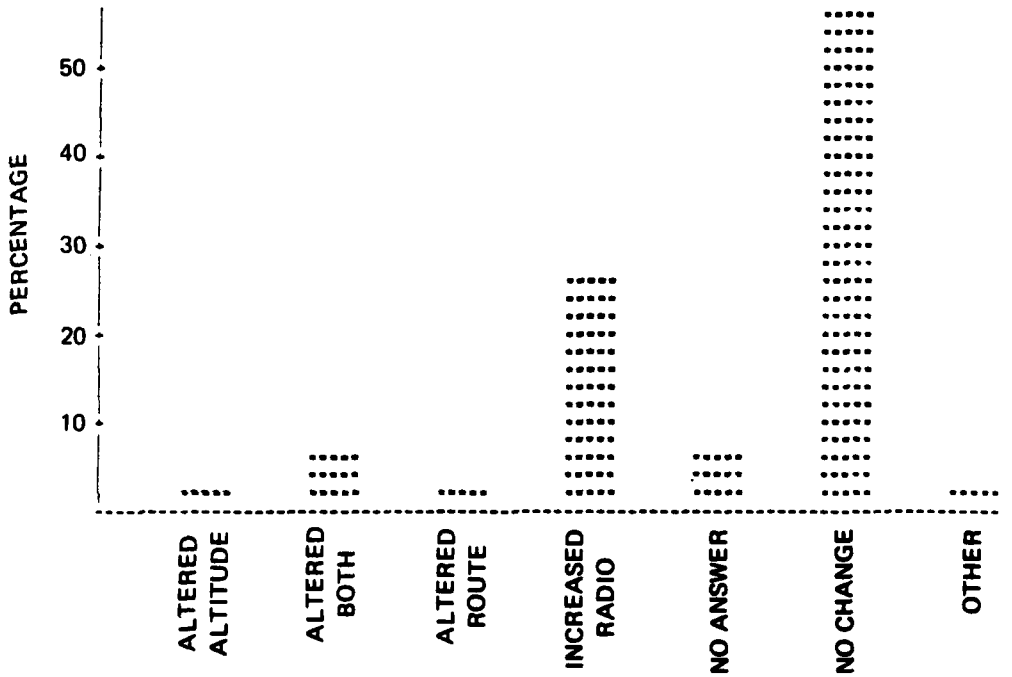
COST	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	565	565	99.297	99.297
600	1	566	0.176	99.473
1000	1	567	0.176	99.649
2500	1	568	0.176	99.824
3000	1	569	0.176	100.000

11) How did the ARSA implementation impact your flying?

- ☐ no change
- ☐ increased radio contacts with ATC
- ☐ altered altitude to avoid ARSA
- ☐ altered route of flight to avoid ARSA
- ☐ other *(Explain under Remarks)*

IMPACT	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NO CHANGE	318	318	55.888	55.888
INCREASED RADIO	145	463	25.483	81.371
ALTERED ALTITUDE	12	475	2.109	83.480
ALTERED ROUTE	16	491	2.812	86.292
OTHER	13	504	2.285	88.576
ALTERED BOTH	31	535	5.448	94.025
NO ANSWER	34	569	5.975	100.000

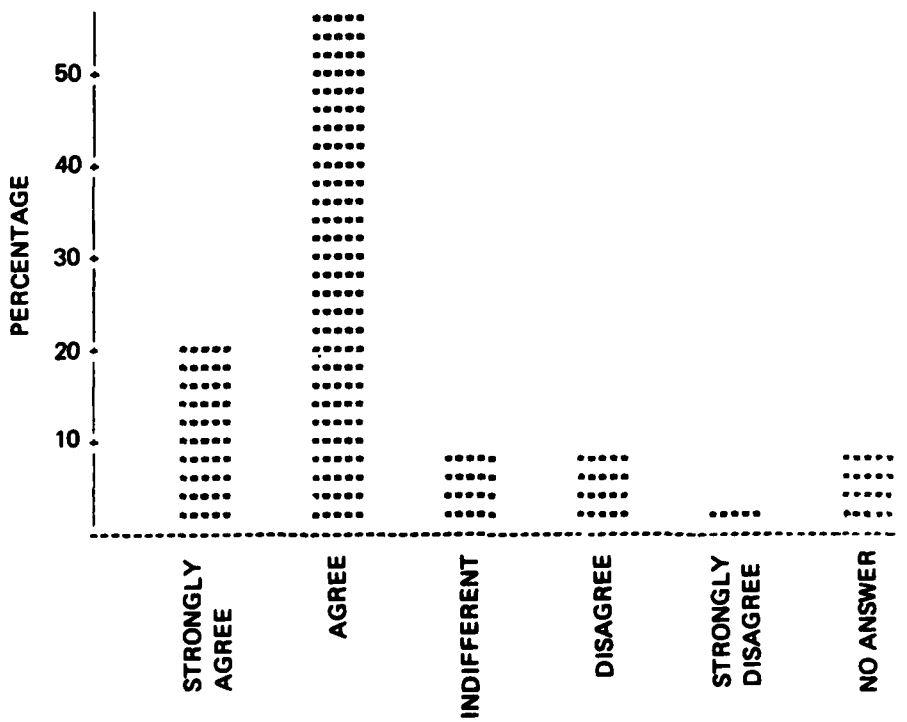
PERCENTAGE BAR CHART



Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
12) Generally understand the services available within the ARSA.	☐	☐	☐	☐	☐

Q12	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	109	109	19.156	19.156
AGREE	316	425	55.536	74.692
INDIFFERENT	51	476	8.963	83.656
DISAGREE	41	517	7.206	90.861
STRONGLY DISAGREE	6	523	1.054	91.916
NO ANSWER	46	569	8.084	100.000

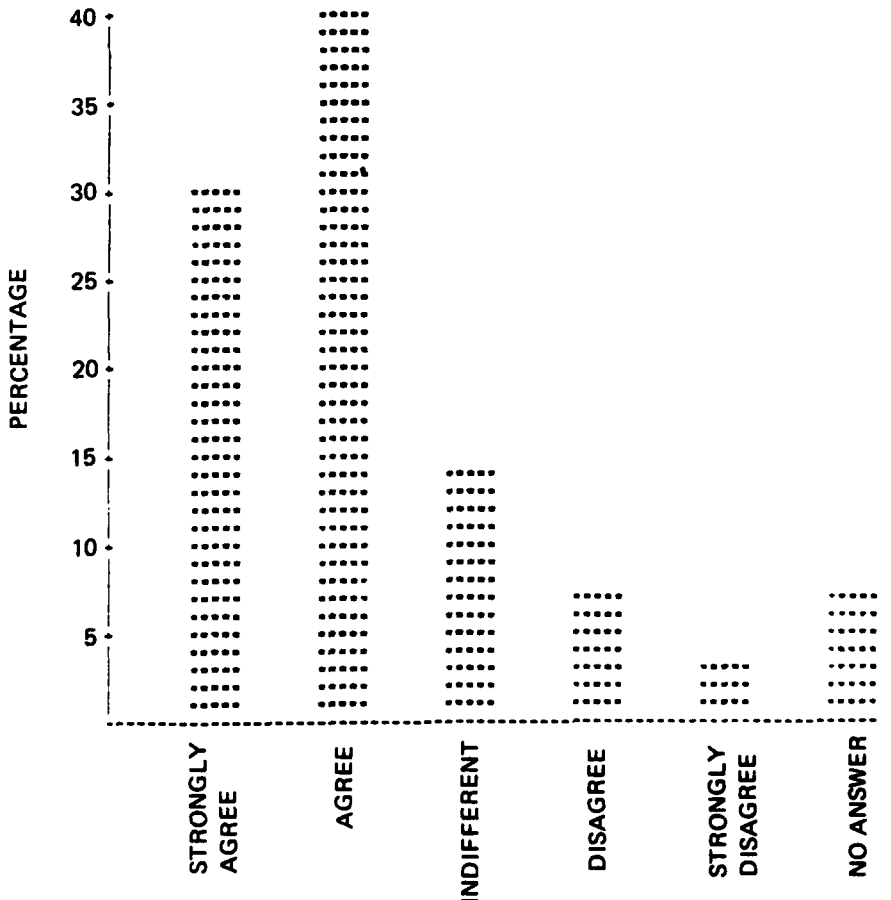
PERCENTAGE BAR CHART



Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
13) Safety is enhanced due to participation of all aircraft within the ARSA.	☐	☐	☐	☐	☐

Q13	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	170	170	29.877	29.877
AGREE	228	398	40.070	69.947
INDIFFERENT	77	475	13.533	83.480
DISAGREE	38	513	6.678	90.158
STRONGLY DISAGREE	15	528	2.636	92.794
NO ANSWER	41	569	7.206	100.000

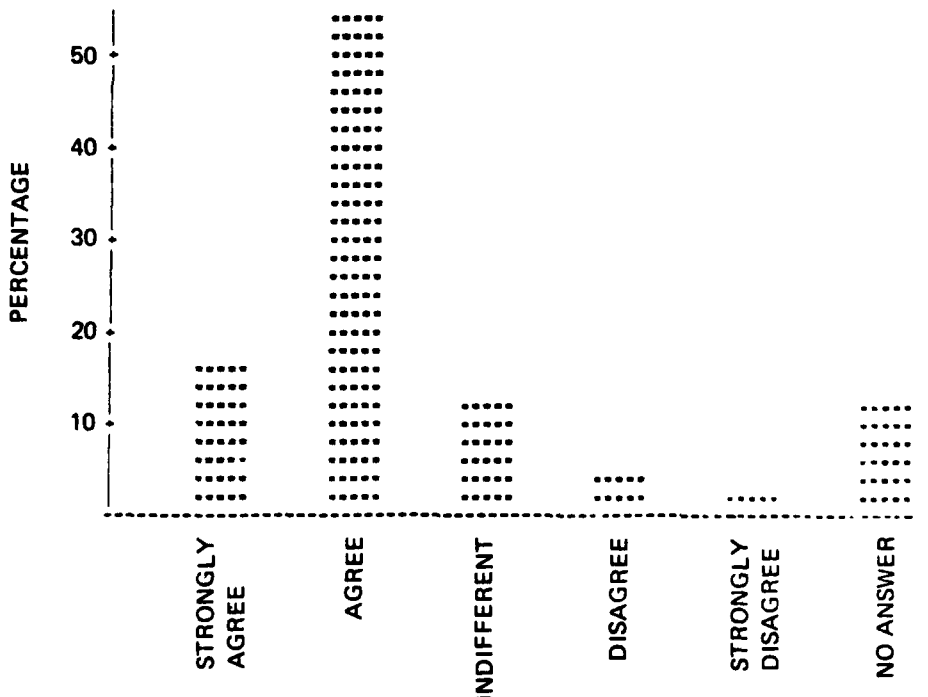
PERCENTAGE BAR CHART



Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
14) Given similar flight situations, the service provided to you by ATC was consistent.	☐	☐	☐	☐	☐

Q14	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	95	95	16.696	16.696
AGREE	305	400	53.603	70.299
INDIFFERENT	71	471	12.478	82.777
DISAGREE	23	494	4.042	86.819
STRONGLY DISAGREE	8	502	1.406	88.225
NO ANSWER	67	569	11.775	100.000

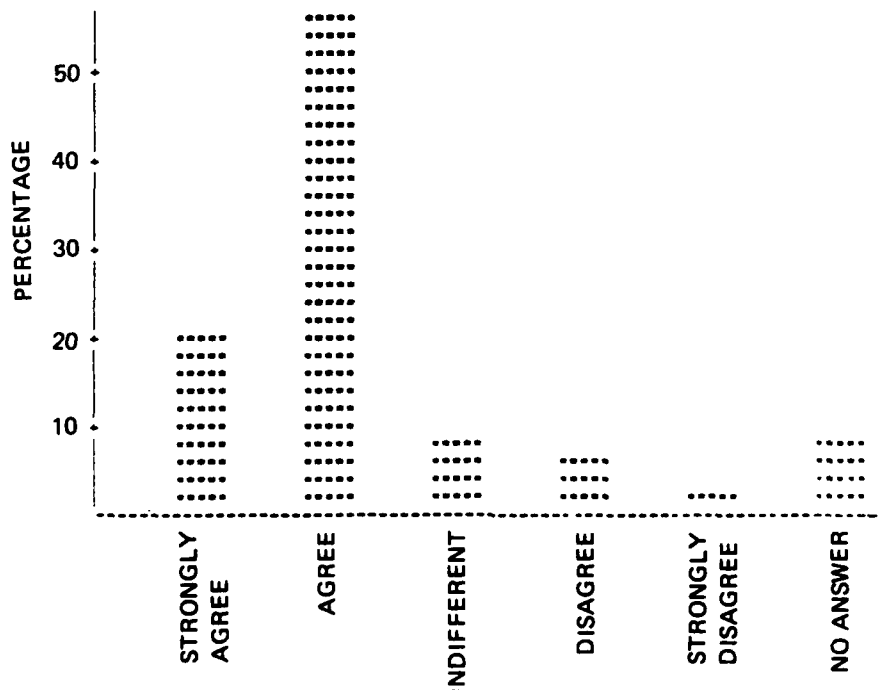
PERCENTAGE BAR CHART



Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
15) The two-way radio communication requirements within the ARSA are acceptable.	☐	☐	☐	☐	☐

Q15	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	114	114	20.035	20.035
AGREE	320	434	56.239	76.274
INDIFFERENT	46	480	8.084	84.359
DISAGREE	34	514	5.975	90.334
STRONGLY DISAGREE	6	520	1.054	91.388
NO ANSWER	49	569	8.612	100.000

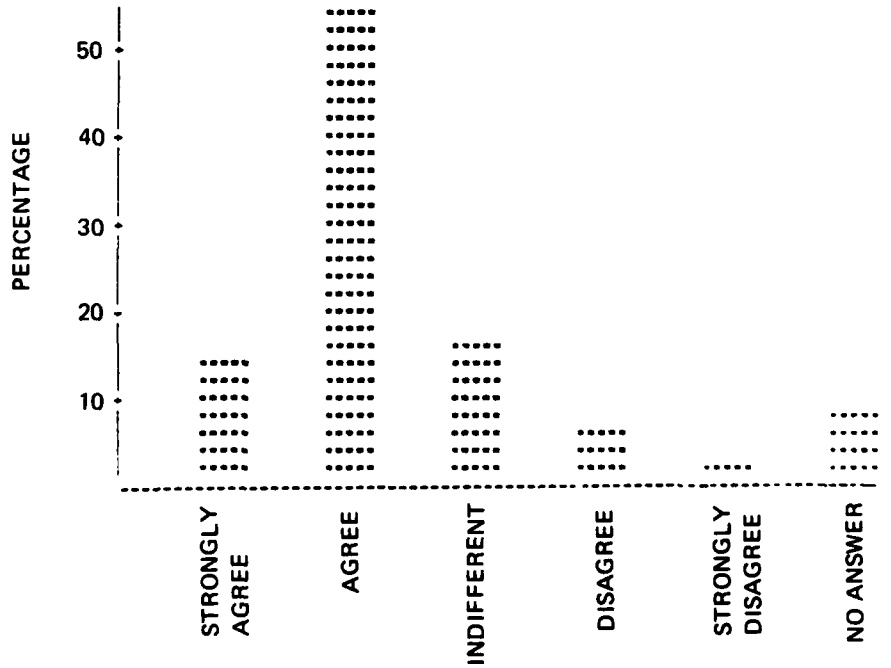
PERCENTAGE BAR CHART



Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
16) The shape of the ARSA is acceptable.	☐	☐	☐	☐	☐

Q16	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	78	78	13.708	13.708
AGREE	304	382	53.427	67.135
INDIFFERENT	90	472	15.817	82.953
DISAGREE	34	506	5.975	88.928
STRONGLY DISAGREE	14	520	2.460	91.388
NO ANSWER	49	569	8.612	100.000

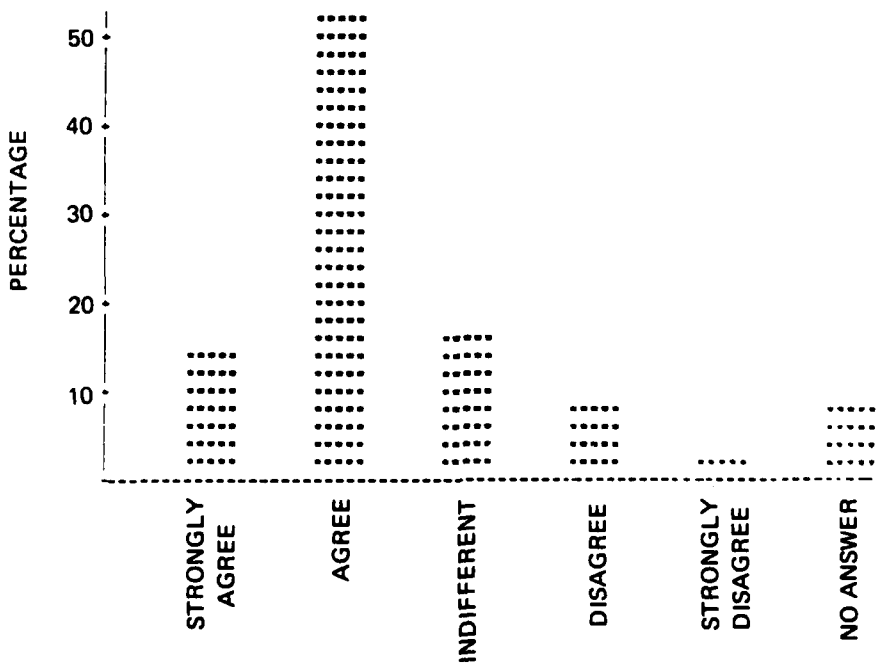
PERCENTAGE BAR CHART



Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
17) The dimensions of the ARSA are acceptable.	☐	☐	☐	☐	☐

Q17	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	74	74	13.005	13.005
AGREE	301	375	52.900	65.905
INDIFFERENT	91	466	15.993	81.898
DISAGREE	41	507	7.206	89.104
STRONGLY DISAGREE	12	519	2.109	91.213
NO ANSWER	50	569	8.787	100.000

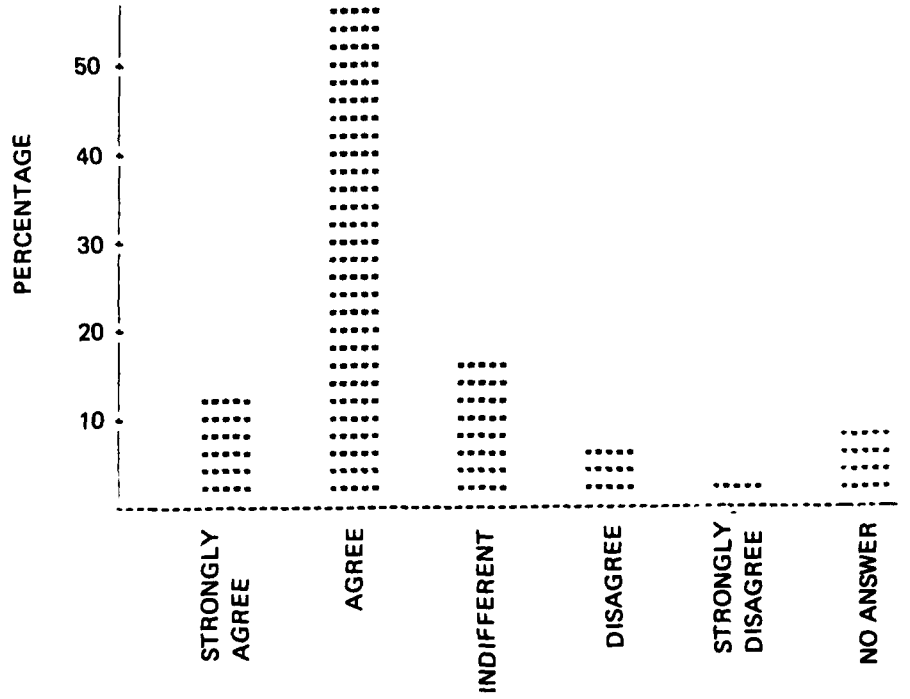
PERCENTAGE BAR CHART



Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
18) ARSA depiction on FAA charts is acceptable.	☐	☐	☐	☐	☐

Q18	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	63	63	11.072	11.072
AGREE	322	385	56.591	67.663
INDIFFERENT	95	480	16.696	84.359
DISAGREE	31	511	5.448	89.807
STRONGLY DISAGREE	7	518	1.230	91.037
NO ANSWER	51	569	8.963	100.000

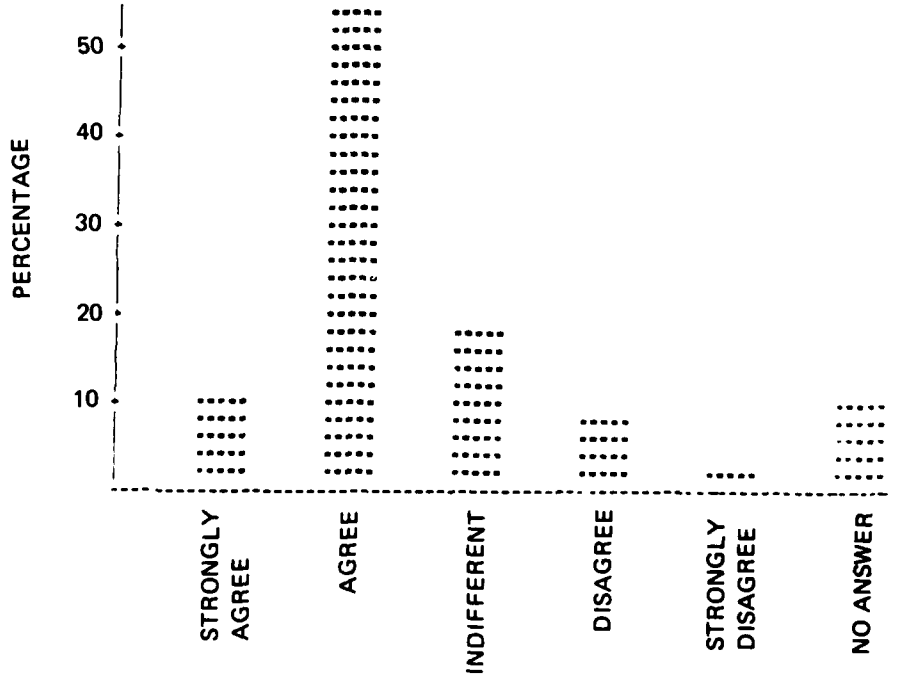
PERCENTAGE BAR CHART



Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
19) ARSA frequency information on FAA charts is acceptable.	☐	☐	☐	☐	☐

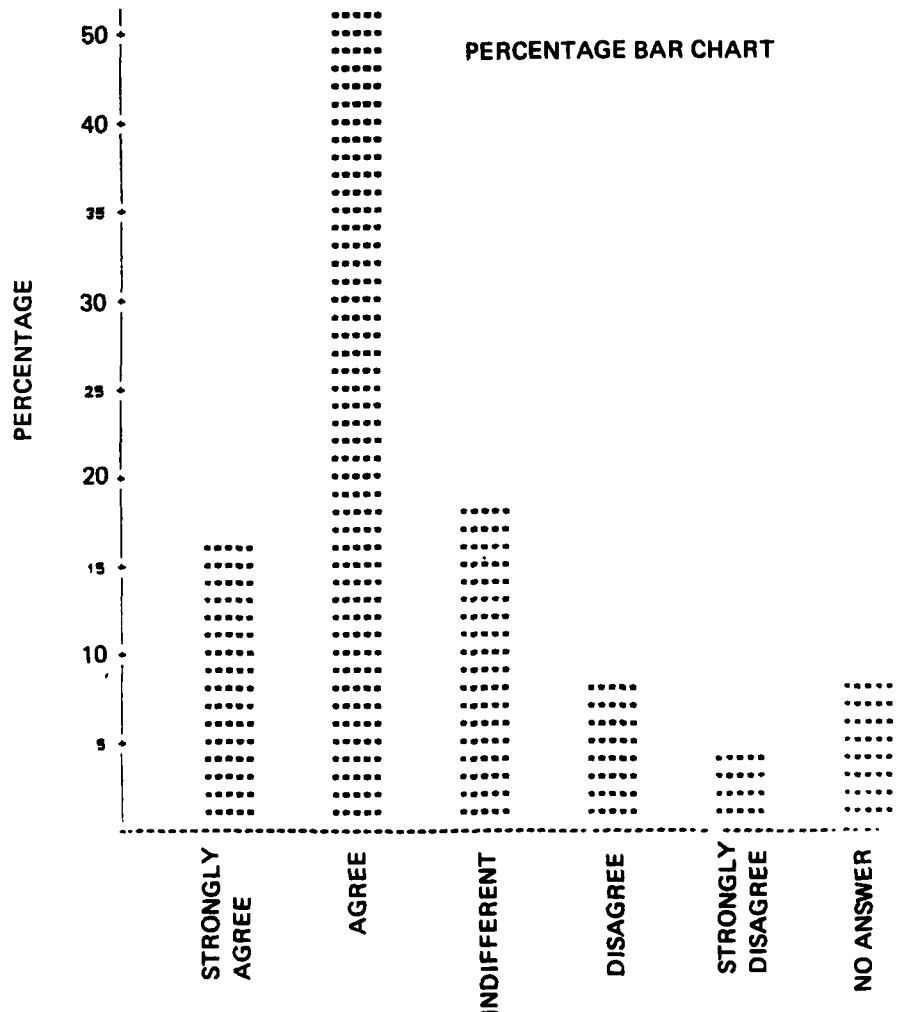
Q19	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	57	57	10.018	10.018
AGREE	308	365	54.130	64.148
INDIFFERENT	101	466	17.750	81.898
DISAGREE	42	508	7.381	89.279
STRONGLY DISAGREE	7	515	1.230	90.510
NO ANSWER	54	569	9.490	100.000

PERCENTAGE BAR CHART



Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
20) Reaction to participating in the ARSA is positive.	☐	☐	☐	☐	☐

Q20	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	92	92	16.169	16.169
AGREE	260	352	45.694	61.863
INDIFFERENT	101	453	17.750	79.613
DISAGREE	45	498	7.909	87.522
STRONGLY DISAGREE	23	521	4.042	91.564
NO ANSWER	48	569	8.436	100.000



LOCAL PILOT QUESTIONNAIRE RESPONSES
(RESPONSE PERCENTAGES TO OPINION QUESTIONS)

PERSONAL OPINION	STRONGLY AGREE	AGREE	INDIFFERENT	DISAGREE	STRONGLY DISAGREE	NO ANSWER
12) Generally understand the services available within the ARSA.	19%	56%	9%	7%	1%	8%
13) Safety is enhanced due to participation of all aircraft within the ARSA.	30%	40%	13%	7%	3%	7%
14) Given similar flight situations, the service provided to you by ATC was consistent.	17%	54%	12%	4%	1%	12%
15) The two-way radio communication requirements within the ARSA are acceptable.	20%	56%	8%	6%	1%	9%
16) The shape of the ARSA is acceptable.	14%	53%	16%	6%	2%	9%
17) The dimensions of the ARSA are acceptable.	13%	53%	16%	7%	2%	9%
18) ARSA depiction on FAA charts is acceptable.	11%	57%	17%	5%	1%	9%
19) ARSA frequency information on FAA charts is acceptable.	10%	54%	18%	7%	1%	10%
20) Reaction to participating in the ARSA is positive.	16%	46%	18%	8%	4%	8%

Summary of the Local Pilot's Written Comments:

Austin, Texas:

Of the 268 pilots who responded from the Austin, Texas area, only 82 pilots provided written comments. Of these, 32 were positive comments, 25 were negative comments, and 25 comments were indifferent in nature. Positive comments highlighted pilots view that safety was enhanced due to participation in ARSA, that ARSA is easier to use and to understand than a TRSA, that ATC services were improved, that they found the system effective and efficient, and that depiction of ARSA on FAA charts was adequate.

Negative comments concerned increased controller workload, increased radio communications, delays due to over congestion on clearance delivery frequency, lack of clarity in altitude blocks on the sectional chart and a decrease in ATC services provided. 186 pilots did not give any written remarks/comments on the ARSA operational confirmation program.

Columbus, Ohio:

There were 301 total responses to the questionnaire from the Columbus, Ohio area. Of these, 202 did not give any additional opinions/remarks. Of the remaining 99 responses, 29 had positive comments, 47 had negative comments and 23 comments were indifferent in nature. Positive comments generally stated that ARSA is very conducive to increased safety in commercial as well as general aviation use and that safety is enhanced by having everyone talk to ATC.

Negative written comments from pilots in Columbus were concerned with increased controller workload, inability to communicate on 90 channel radio equipment, radio congestion due to VFR aircraft flying in the "outer limits" area being accomodated and a slight decrease in services caused by extensive vectoring and sequencing. They also noted that hand offs were not coordinated.

APPENDIX F

ITINERANT PILOTS RESPONSE DATA

1) Check all appropriate Certificates and Ratings Attained.

☐ Student	☐ Single Engine
☐ Private	☐ Multi-engine
☐ Commercial	☐ Instrument
☐ Air Transport	☐ Rotorcraft
☐ Flight Instructor	☐ Other_____

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STUDENT	3	3	2.055	2.055
PRIVATE	33	36	22.603	24.658
COMMERCIAL	46	82	31.507	56.164
AIR TRANSPORT	64	146	43.836	100.000

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
INSTRUCTOR	62	62	42.466	42.466
NOT A INSTRUCTOR	84	146	57.534	100.000

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
SINGLE ENGINE	28	28	19.178	19.178
SINGLE & MULTI	80	108	54.795	73.973
ROTORCRAFT	4	112	2.740	76.712
SINGLE MULTI ROT	4	116	2.740	79.452
NO RATINGS	30	146	20.548	100.000

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
INSTRUMENT RATIN	78	78	53.425	53.425
NOT INSTRU RATIN	68	146	46.575	100.000

2) Type Aircraft/Vehicle Flown:

- ☐ Single Engine, Piston
- ☐ Multi-engine, Piston
- ☐ Turbo prop
- ☐ Jet
- ☐ Rotorcraft
- ☐ Ultra light or glider
- ☐ Other_____

AIRCRAFT	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
SINGLE ENGINE	52	52	35.616	35.616
MULTI ENGINE	13	65	8.904	44.521
TURBO PROP	13	78	8.904	53.425
JET	13	91	8.904	62.329
ROTORCRAFT	9	100	6.164	68.493
ULTRALIGHT/GLIDE	2	102	1.370	69.863
ALL THE ABOVE	1	103	0.685	70.548
SINGLE AND MULTI	16	119	10.959	81.507
TURBO AND JET	3	122	2.055	83.562
TURBO SINGLE MULTI	16	138	10.959	94.521
SIN MULT JET TURBO	8	146	5.479	100.000

3) Flight Type:

- ☐ Personal (including Practice)
- ☐ Business
- ☐ Instruction
- ☐ Military
- ☐ Executive/Corporate
- ☐ On demand Air Taxi
- ☐ Air Carrier
- ☐ Other_____

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
PERSONAL	14	14	9.589	9.589
BUSINESS	27	41	18.493	28.082
INSTRUCTION	2	43	1.370	29.452
MILITARY	1	44	0.685	30.137
EXECUTIVE/CORPOR	5	49	3.425	33.562
AIR TAXI	6	55	4.110	37.671
AIR CARRIER	20	75	13.699	51.370
OTHER	4	79	2.740	54.110
PERSONAL INSTRUC	33	112	22.603	76.712
BUSI EXEC CORP	9	121	6.164	82.877
MILI BUSI PRIV	3	124	2.055	84.932
MILI & AIR CARRI	7	131	4.795	89.726
INSTRUC & BUSINE	15	146	10.274	100.000

4) Avionics Equipment:

☐ Two-way Radio ☐ DME
☐ Transponder ☐ Altitude Encoder (Mode C)
☐ VOR Receiver

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
TWO WAY RADIO	3	3	2.055	2.055
TRANSPONDER & ENCODER	1	4	0.685	2.740
RADIO TRANSPO VOR	22	26	15.068	17.808
ALL FIVE CHOICES	111	137	76.027	93.836
ALL BUT ENCODER	9	146	6.164	100.000

5) Aircraft flown is based at

AIRPORT	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NOANS*				
OTHER				
PRIME				
SATEL				
SECON				

NOANS* = No Answer

6) Where did you learn of the services provided in the ARSA?

☐ FAA Public meeting
☐ FAA Publications
☐ Letter to Airmen
☐ Private Publications. Which _____
☐ User Group. Name of organization _____
Other (*please specify*) _____

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
FAA MEETINGS	10	10	6.849	6.849
FAA PUBLICATION	53	63	36.301	43.151
LETTER TO AIRMEN	2	65	1.370	44.521
PUBLICATION & LE	5	70	3.425	47.945
PRIVATE PUBLICAT	35	105	23.973	71.918
USER GROUP	23	128	15.753	87.671
OTHER	9	137	6.164	93.836
NO ANSWER	9	146	6.164	100.000

7) Check the number of times flow within the ARSA (5 and 10 nm radius) in the following months considering both arrivals and departures as separate flights.

DEC	JAN	FEB	MAR	APR
☐ None	☐ None	☐ None	☐ None	☐ None
☐ 1-10	☐ 1-10	☐ 1-10	☐ 1-10	☐ 1-10
☐ 11-30	☐ 11-30	☐ 11-30	☐ 11-30	☐ 11-30
☐ 31-50	☐ 31-50	☐ 31-50	☐ 31-50	☐ 31-50
☐ over 50	☐ over 50	☐ over 50	☐ over 50	☐ over 50

DEC	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NONE	55	55	37.671	37.671
1 TO 10	56	111	38.356	76.027
11 TO 30	20	131	13.699	89.726
31 TO 50	5	136	3.425	93.151
OVER 50	1	137	0.685	93.836
NO ANSWER	9	146	6.164	100.000

JAN	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NONE	52	52	35.616	35.616
1 TO 10	57	109	39.041	74.658
11 TO 30	22	131	15.068	89.726
31 TO 50	5	136	3.425	93.151
OVER 50	1	137	0.685	93.836
NO ANSWER	9	146	6.164	100.000

FEB	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NONE	44	44	30.137	30.137
1 TO 10	59	103	40.411	70.548
11 TO 30	27	130	18.493	89.041
31 TO 50	6	136	4.110	93.151
OVER 50	1	137	0.685	93.836
NO ANSWER	9	146	6.164	100.000

MARCH	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NONE	31	31	21.233	21.233
1 TO 10	68	99	46.575	67.808
11 TO 30	26	125	17.808	85.616
31 TO 50	9	134	6.164	91.781
OVER 50	3	137	2.055	93.836
NO ANSWER	9	146	6.164	100.000

APRIL	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NONE	21	21	14.384	14.384
1 TO 10	71	92	48.630	63.014
11 TO 30	30	122	20.548	83.562
31 TO 50	11	133	7.534	91.096
OVER 50	4	137	2.740	93.836
NO ANSWER	9	146	6.164	100.000

8) Were most of your flights? ☐ IFR ☐ VFR

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
BOTH	7	7	4.795	4.795
IFR	57	64	39.041	43.836
VFR	77	141	52.740	96.575
NO ANSWER	5	146	3.425	100.000

9) Were most of your flights?
☐ to/from primary airport ☐ overflight/bypass primary airport

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
TO/FROM PRIMARY	102	102	69.863	69.863
BYPASS	32	134	21.918	91.781
BOTH	6	140	4.110	95.890
NO ANSWER	6	146	4.110	100.000

10) Did you have to purchase a two-way radio in order to operate in the ARSA?
☐ Yes (Total cost installed $ _____). ☐ No

	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NO	143	143	97.945	97.945
YES	1	144	0.685	98.630
NO ANSWER	2	146	1.370	100.000

COST	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	145	145	99.315	99.315
1400	1	146	0.685	100.000

11) How did the ARSA implementation impact your flying?

- ☐ no change
- ☐ increased radio contacts with ATC
- ☐ altered altitude to avoid ARSA
- ☐ altered route of flight to avoid ARSA
- ☐ other *(Explain under Remarks)*

IMPACT	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
NO CHANGE	82	82	56.164	56.164
INCREASED RADIO	40	122	27.397	83.562
ALTERED ALTITUDE	1	123	0.685	84.247
ALTERED ROUTE	3	126	2.055	86.301
OTHER	7	133	4.795	91.096
ALTERED BOTH	12	145	8.219	99.315
NO ANSWER	1	146	0.685	100.000

Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
12) Generally understand the services available within the ARSA.	☐	☐	☐	☐	☐

Q12	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	34	34	23.288	23.288
AGREE	74	108	50.685	73.973
INDIFFERENT	19	127	13.014	86.986
DISAGREE	7	134	4.795	91.781
STRONGLY DISAGREE	6	140	4.110	95.890
NO ANSWER	6	146	4.110	100.000

Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
13) Safety is enhanced due to participation of all aircraft within the ARSA.	☐	☐	☐	☐	☐

Q13	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	37	37	25.342	25.342
AGREE	45	82	30.822	56.164
INDIFFERENT	21	103	14.384	70.548
DISAGREE	19	122	13.014	83.562
STRONGLY DISAGREE	22	144	15.068	98.630
NO ANSWER	2	146	1.370	100.000

Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
14) Given similar flight situations, the service provided to you by ATC was consistent.	☐	☐	☐	☐	☐

Q14	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	25	25	17.123	17.123
AGREE	78	103	53.425	70.548
INDIFFERENT	15	118	10.274	80.822
DISAGREE	19	137	13.014	93.836
STRONGLY DISAGREE	4	141	2.740	96.575
NO ANSWER	5	146	3.425	100.000

Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
15) The two-way radio communication requirements within the ARSA are acceptable.	☐	☐	☐	☐	☐

Q15	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	31	31	21.233	21.233
AGREE	66	97	45.205	66.438
INDIFFERENT	13	110	8.904	75.342
DISAGREE	10	120	6.849	82.192
STRONGLY DISAGREE	22	142	15.068	97.260
NO ANSWER	4	146	2.740	100.000

Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
16) The shape of the ARSA is acceptable.	☐	☐	☐	☐	☐

Q16	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	24	24	16.438	16.438
AGREE	72	96	49.315	65.753
INDIFFERENT	22	118	15.068	80.822
DISAGREE	5	123	3.425	84.247
STRONGLY DISAGREE	18	141	12.329	96.575
NO ANSWER	5	146	3.425	100.000

Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
17) The dimensions of the ARSA are acceptable.	☐	☐	☐	☐	☐

Q17	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	24	24	16.438	16.438
AGREE	65	89	44.521	60.959
INDIFFERENT	19	108	13.014	73.973
DISAGREE	18	126	12.329	86.301
STRONGLY DISAGREE	16	142	10.959	97.260
NO ANSWER	4	146	2.740	100.000

Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
18) ARSA depiction on FAA charts is acceptable.	☐	☐	☐	☐	☐

Q18	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	24	24	16.438	16.438
AGREE	65	89	44.521	60.959
INDIFFERENT	30	119	20.548	81.507
DISAGREE	15	134	10.274	91.781
STRONGLY DISAGREE	6	140	4.110	95.890
NO ANSWER	6	146	4.110	100.000

Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
19) ARSA frequency information on FAA charts is acceptable.	☐	☐	☐	☐	☐

Q19	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	17	17	11.644	11.644
AGREE	70	87	47.945	59.589
INDIFFERENT	35	122	23.973	83.562
DISAGREE	8	130	5.479	89.041
STRONGLY DISAGREE	8	138	5.479	94.521
NO ANSWER	8	146	5.479	100.000

Personal Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
20) Reaction to participating in the ARSA is positive.	☐	☐	☐	☐	☐

Q20	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	24	24	16.438	16.438
AGREE	53	77	36.301	52.740
INDIFFERENT	18	95	12.329	65.068
DISAGREE	16	111	10.959	76.027
STRONGLY DISAGREE	31	142	21.233	97.260
NO ANSWER	4	146	2.740	100.000

ITINERANT PILOT QUESTIONNAIRE RESPONSES
(RESPONSE PERCENTAGES TO OPINION QUESTIONS)

PERSONAL OPINION	STRONGLY AGREE	AGREE	INDIFFERENT	DISAGREE	STRONGLY DISAGREE	NO ANSWER
12) Generally understand the services available within the ARSA.	23%	51%	13%	5%	4%	4%
13) Safety is enhanced due to participation of all aircraft within the ARSA.	25%	31%	14%	14%	15%	1%
14) Given similar flight situations, the service provided to you by ATC was consistent.	17%	54%	10%	13%	3%	3%
15) The two-way radio communication requirements within the ARSA are acceptable.	21%	45%	9%	7%	15%	3%
16) The shape of the ARSA is acceptable.	17%	49%	15%	4%	12%	3%
17) The dimensions of the ARSA are acceptable.	16%	45%	13%	12%	11%	3%
18) ARSA depiction on FAA charts is acceptable.	16%	45%	21%	10%	4%	4%
19) ARSA frequency information on FAA charts is acceptable.	12%	48%	24%	6%	5%	5%
20) Reaction to participating in the ARSA is positive.	17%	36%	12%	11%	21%	3%

APPENDIX G

CONTROLLER RESPONSE DATA

1. Check your appropriate work areas and please indicate your qualifications.

WORK AREA	QUALIFICATIONS
[ ] Radar	[ ] Trainee
[ ] Tower	[ ] Qualified on some positions
[ ] Radar and Tower	[ ] Fully qualified Radar Controller
	[ ] Fully qualified Tower Controller
	[ ] Fully qualified Radar and Tower Controller

AREA	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
RADAR	2	2	3.571	3.571
TOWER	9	11	16.071	19.643
RADAR AND TOWER	45	56	80.357	100.000

QUALIFY	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
QUALIFY SOME POS	2	2	3.571	3.571
RADAR CONTROLLER	1	3	1.786	5.357
TOWER CONTROLLER	13	16	23.214	28.571
RADAR AND TOWER	40	56	71.429	100.000

2. Check your appropriate type and length of ATC experience.

	TYPE		LENGTH
[ ]	FAA	[ ]	1 to 5 years
[ ]	Military	[ ]	5 to 10 years
[ ]	Other	[ ]	More than 10 years

Specify_____

TYPE	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
FAA	52	52	92.857	92.857
MILITARY	3	55	5.357	98.214
NO ANSWER	1	56	1.786	100.000

LENGTH	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
1 TO 5 YRS	12	12	21.429	21.429
5 TO 10 YRS	7	19	12.500	33.929
MORE THAN 10 YRS	37	56	66.071	100.000

3. Pilots generally understand the services available within the ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q3	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	2	2	3.571	3.571
AGREE	36	38	64.286	67.857
INDIFFERENT	5	43	8.929	76.786
DISAGREE	13	56	23.214	100.000

4. Controllers are aware of the positions, altitudes, and intents of all aircraft within the ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q4	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	6	6	10.714	10.714
AGREE	25	31	44.643	55.357
INDIFFERENT	10	41	17.857	73.214
DISAGREE	12	53	21.429	94.643
STRONGLY DISAGREE	2	55	3.571	98.214
NO ANSWER	1	56	1.786	100.000

5. Safety is enhanced because of participation of all aircraft within the ARSA boundary.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q5	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	10	10	17.857	17.857
AGREE	22	32	39.286	57.143
INDIFFERENT	8	40	14.286	71.429
DISAGREE	11	51	19.643	91.071
STRONGLY DISAGREE	5	56	8.929	100.000

6. Controllers received sufficient training about ARSA prior to ARSA implementation.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q6	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	7	7	12.500	12.500
AGREE	24	31	42.857	55.357
INDIFFERENT	7	38	12.500	67.857
DISAGREE	14	52	25.000	92.857
STRONGLY DISAGREE	4	56	7.143	100.000

7. Pilots understand the size and shape of ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q7	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	1	1	1.786	1.786
AGREE	27	28	48.214	50.000
INDIFFERENT	11	39	19.643	69.643
DISAGREE	13	52	23.214	92.857
STRONGLY DISAGREE	3	55	5.357	98.214
NO ANSWER	1	56	1.786	100.000

8. ATC is receiving pilot participation in ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q8	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	13	13	23.214	23.214
AGREE	37	50	66.071	89.286
INDIFFERENT	4	54	7.143	96.429
DISAGREE	2	56	3.571	100.000

9. Pilot participation in ATC services is higher in ARSA than what it was prior to ARSA implementation.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q9	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	16	16	28.571	28.571
AGREE	31	47	55.357	83.929
INDIFFERENT	8	55	14.286	98.214
DISAGREE	1	56	1.786	100.000

10. ATC procedures are simpler to implement under ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

If you disagree or strongly disagree with the question above, please check one of the following:

[ ] The same difficulty as pre-ARSA

[ ] More difficult than pre-ARSA

Q10	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
SIMPLER	9	9	16.071	16.071
INDIFFERENT	18	27	32.143	48.214
SAME	8	35	14.286	62.500
MORE DIFFICULT	19	54	33.929	96.429
NO ANSWER	2	56	3.571	100.000

11. Average time communicating with each pilot under ARSA is about the same as before ARSA was implemented.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

If you disagree or strongly disagree with the question above, please check one of the following:

[ ] Average time communicating with each pilot is longer than pre-ARSA

[ ] Average time communicating with each pilot is shorter than pre-ARSA

Q11	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
SAME	4	4	7.143	7.143
INDIFFERENT	26	30	46.429	53.571
LONGER	20	50	35.714	89.286
SHORTER	6	56	10.714	100.000

12. There are no increased delays as a result of ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q12	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	8	8	14.286	14.286
AGREE	27	35	48.214	62.500
INDIFFERENT	7	42	12.500	75.000
DISAGREE	13	55	23.214	98.214
STRONGLY DISAGREE	1	56	1.786	100.000

13. Controller workload under ARSA is about the same as before ARSA was implemented.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

If you disagree or strongly disagree with the question above, please check one of the following:

[ ] Perceived increase

[ ] Perceived decrease

Q13	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
SAME	11	11	19.643	19.643
INDIFFERENT	3	14	5.357	25.000
INCREASE	40	54	71.429	96.429
DECREASE	2	56	3.571	100.000

14. Pilots generally have a position reaction to participating in the ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q14	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	7	7	12.500	12.500
AGREE	30	37	53.571	66.071
INDIFFERENT	16	53	28.571	94.643
DISAGREE	3	56	5.357	100.000

APPENDIX H

SUPERVISOR/MANAGEMENT STAFF RESPONSE DATA

1. Please indicate type and level of facility.

TYPE		LEVEL	
[ ]	FAA	[ ]	Level III
[ ]	Military	[ ]	Level IV
[ ]	Civil	[ ]	RAPCON
		[ ]	Tower only

TYPE	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
FAA	12	12	92.308	92.308
CIVIL	1	13	7.692	100.000

LEVEL	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
LEVEL 3	6	6	46.154	46.154
LEVEL 4	7	13	53.846	100.000

2. Overall controller workload since implementation of ARSA is about the same as before ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q2	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	1	1	7.692	7.692
AGREE	3	4	23.077	30.769
DISAGREE	8	12	61.538	92.308
STRONGLY DISAGREE	1	13	7.692	100.000

3. There have been very few complaints about ARSA from the Controller staff.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q3	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	3	3	23.077	23.077
AGREE	5	8	38.462	61.538
INDIFFERENT	1	9	7.692	69.231
DISAGREE	3	12	23.077	92.308
STRONGLY DISAGREE	1	13	7.692	100.000

4. There have been very few complaints about ARSA from the flying public.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

If you disagree or strongly disagree with the above question, please indicate the main area of complaints from the flying public.

[ ] ATC services

[ ] Delays

[ ] Shape/Dimension of ARSA

[ ] ARSA depiction/frequency on FAA charts

[ ] Others, please explain _____

_____

Q4	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	5	5	38.462	38.462
AGREE	6	11	46.154	84.615
DISAGREE	2	13	15.385	100.000

COMPLAINT	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
DELAYS	2	2	15.385	15.385
OTHERS	1	3	7.692	23.077
NO COMPLAINTS	10	13	76.923	100.000

5. Safety is enhanced by ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q5	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	2	2	15.385	15.385
AGREE	6	8	46.154	61.538
INDIFFERENT	1	9	7.692	69.231
DISAGREE	3	12	23.077	92.308
STRONGLY DISAGREE	1	13	7.692	100.000

6. Pilots generally understand the services available within ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q6	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
AGREE	9	9	69.231	69.231
DISAGREE	3	12	23.077	92.308
STRONGLY DISAGREE	1	13	7.692	100.000

7. Commanders of adjacent military airports have registered fewer complaints about ATC services since ARSA implementation.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q7	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	2	2	15.385	15.385
AGREE	4	6	30.769	46.154
INDIFFERENT	6	12	46.154	92.308
NO ANSWER	1	13	7.692	100.000

8. Since the implementation of ARSA, administration of the facility has been the same as pre-ARSA.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

If you disagree or strongly disagree with the question above, please complete the following question.

Since the implementation of ARSA, has administration been easier or more difficult?

[ ] Easier

[ ] More difficult

Q8	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
SAME	8	8	61.538	61.538
INDIFFERENT	2	10	15.385	76.923
MORE DIFFICULT	3	13	23.077	100.000

9. ARSA operations at this facility should be continued indefinitely.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q9	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	5	5	38.462	38.462
AGREE	7	12	53.846	92.308
DISAGREE	1	13	7.692	100.000

10. ARSA should be implemented nationally at all present TRSA locations.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q10	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	1	1	7.692	7.692
AGREE	8	9	61.538	69.231
INDIFFERENT	1	10	7.692	76.923
DISAGREE	2	12	15.385	92.308
STRONGLY DISAGREE	1	13	7.692	100.000

11. ATC coordination between controllers at primary airports and secondary airports has not increased since ARSA implementation.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q11	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	2	2	15.385	15.385
AGREE	8	10	61.538	76.923
DISAGREE	2	12	15.385	92.308
STRONGLY DISAGREE	1	13	7.692	100.000

If you disagree or strongly disagree, please complete the following statement:

[ ] Coordination has increased; percentage increase _____

PERCENT	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	10	10	76.923	76.923
15	2	12	15.385	92.308
75	1	13	7.692	100.000

12. Overall, the acceptance of ARSA by pilots has been favorable.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q12	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	3	3	23.077	23.077
AGREE	9	12	69.231	92.308
INDIFFERENT	1	13	7.692	100.000

13. Overall, the acceptance of ARSA by controllers has been favorable.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q13	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	3	3	23.077	23.077
AGREE	8	11	61.538	84.615
DISAGREE	2	13	15.385	100.000

14. Overall, the acceptance of ARSA by management has been favorable.

[ ] Strongly Agree

[ ] Agree

[ ] Indifferent

[ ] Disagree

[ ] Strongly Disagree

Q14	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
STRONGLY AGREE	4	4	30.769	30.769
AGREE	8	12	61.538	92.308
STRONGLY DISAGREE	1	13	7.692	100.000

APPENDIX I

SURFACE WEATHER OBSERVATIONS FOR THE TWO LEAD SITES

ROBERT MUELLER MUNICIPAL AIRPORT - AUSTIN, TEXAS

PRE ARSA

DATE	DAY	LOCAL STANDARD TIME: HOUR																								REMARKS
		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
11-16-83	WED	○ 20 7	○ 20 7	○ 20 5	○ 20 6	○ 20 8	○ 20 3	○ 20 4	○ 20 5	○ 20 4	○ 20 4	○ 20 6	○ 20 8	○ 20 7	○ 20 11	◍ 250 20 10	○ 20 11	○ 20 10	○ 20 5	○ 20 6	○ 20 5	○ 20 6	○ 20 7	○ 20 6	○ 20 7	
11-17-83	THU	○ 20 5	○ 20 3	○ 20 5	○ 20 3	○ 20 3	○ 20 4	○ 20 3	○ 20 4	①① 20, 250 20 5	◉① 28, 250 20 6	①① 30, 250 20 13G20	①◉ 36, 250 20 11G20	①① 40, 250 20 16G25	①① 40,250 20 17G26	①① 40, 250 20 13G12	①① 40, 250 20 13G22	①◉ 40, 250 20 13G19	①◉ 38,250 20 8	①① 35, 250 20 10	◉ 24 15 10	◉ 17 10 9	◉ 15 10 8	◉ 13 10 9	◉ 12 10 9	EXPLANATION OF HOURLY REPORTED WEATHER DATA BLOCKS SEE LEGEND AS AN EXAMPLE
11-18-83	FRI	⊕ 10 10 10	◉ 11 10 7	⊕ 12 10 7	⊕ 13 10 6	⊕ 12 10 10	⊕ 10 10R 8	◉ 11 10 9G15	◉ 12 9 12G19	◉ 14 12 12G21	⊕ 17 15 11G20	⊕ 23 15 14G23	⊕ 29 15 14G24	⊕ 29 15 15G26	◉◉ 30, 35 15 15G25	◉◉ 38, 250 15 14G25	◉◉ 38, 250 15 16G22	①① 40 15 14G20	① 37 15 12G20	◉ 20, 37 15 13G20	①⊕ 18, 37 15 13G18	⊕⊕ 15, 40 15 12G18	⊕⊕ 17, 38 15 13G20	◉◉ 17, 38 15 11G19	①◉ 20, 38 15 8	
11-19-83	SAT	① 20 10 10	①◉ 20, 41 10 11G18	◉ 41 10 10	①◉ 24, 43 10 10	①◉ 24, 43 10 14	①◉ 24, 43 10 13G19	◉⊕ 23, 100 10 11G18	◉⊕ 24, 75 9 8	⊕⊕ 24, 75 9 8	⊕⊕ 23, 250 9RW 15G22	◉◉ 28, 250 15 14G21	①① 90, 250 20 17G26	①① 90, 250 20 16G24	①① 40, 250 20 16G28	①① 40, 250 20 26G38	①⊕ 40, 100 15 26G40	①① 40, 120 15 15G22	① 120 15 20G32	① 120 15 18G20	○ 15 15G26	○ 15 15G24	○ 20 12	○ 20 10	○ 20 10	
11-20-83	SUN	○ 20 8	○ 20 6	○ 20 7	○ 20 7	○ 20 4	○ 20 0	○ 20 3	○ 20 3	○ 20 5	○ 20 7	○ 20 6	○ 20 7	○ 20 7	○ 20 9G18	○ 20 12G17	○ 20 10	○ 20 12G20	○ 20 8	○ 20 6	○ 20 7	○ 20 8	○ 20 6	○ 20 9	○ 20 6	
11-21-83	MON	○ 20 7	○ 20 8	○ 20 7	○ 20 7	○ 20 4	○ 20 3	○ 20 3	○ 20 3	① 20 20 6	① 19 15 7	① 25 15 12G20	① 30 15 15G28	① 32 15 14G23	◉ 33 15 15G23	①① 29, 43 15 15G28	①① 32, 43 10 13	①◉ 30, 41 12 12G22	① 30 12 11	◉ 24 15 12G20	◉ 18 15 10	①⊕ 15, 50 15 12	⊕ 15 15 13	⊕ 15 15 9	⊕① 23, 50 15 10	
11-22-83	TUE	⊕ 15 15 9	◑⊕ 13, 50 15 8	◑⊕ 14, 50 10 11	◑◑ 13, 50 8 9	⊕◑ 13, 50 8 10	⊕◉ 17, 50 8 8	⊕⊕ 12, 35 8 8	⊕⊕ 12, 55 4 F 8	⊕⊕ 13, 60 7 12	⊕⊕ 17, 35 8 14G20	◉◉ 24, 40 9 14G23	⊕⊕ 30, 250 10 14G24	⊕⊕ 33, 250 11 13G21	①① 40, 250 11 15G24	① 45 12 12G23	①① 38, 65 12 10	①① 24, 70 10 13G23	①① 19, 250 8 10	⊕⊕ 15, 22 12 10	⊕ 12 12 10	⊕ 11 12 7	⊕ 11 12 12	⊕ 12 12 14G23	⊕WX RW&T 2 31G49	

LEGEND:

○ – SKY CONDITION ○ = CLEAR ① = SCATTERED ◉ = BROKEN ⊕ = OVERCAST ⊗ = X OBSCURED; -X PARTIALLY OBSCURED)
250 – CEILING HEIGHT (HEIGHT OF CLOUD LAYERS EXPRESSED IN HUNDREDS OF FEET AGL)
15 – VISIBILITY (EXPRESSED IN STATUTE MILES)
14G26 – WIND SPEED (EXPRESSED IN KNOTS, "G" INDICATES GUSTY)

SURFACE WEATHER OBSERVATIONS

ROBERT MUELLER MUNICIPAL AIRPORT - AUSTIN, TEXAS

POST-ARSA

DATE	DAY	LOCAL STANDARD TIME: HOUR																								REMARKS
		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
3-1-84	THU	○ 20 5	○ 20 6	○ 20 3	○ 20 3	○ 20 4	○ 20 3	◑ 18 0	● 23 3	● 24 4	● 27 5	● 24 15 13G17	⊕ 30 15 13G17	◑● 27, 32 15 12G18	◑ 30 15 13G20	◑ 37 15 13G22	◑ 40 15 10G20	◑ 40 15 10G19	● 41 20 10	◑ 38 20 11	◑● 26, 26 20 8	◑⊕ 21, 20 15 8	●⊕ 12, 20 16 8	◑● 9, 20 10 10	● 20 10 10	
3-2-84	FRI	⊕ 15 10 7	⊕ 16 10 7	⊕ 14 10 8	⊕ 15 10 8	⊕● 5, 5 7 6	●● 5, 15 7 10	◑● 5, 20 7 8	⊕ 14 6H 9	◑● 6, 18 6H 10	● 18 7 12G20	● 23 8 11	◑ 25 10 11G18	○ 12 10	○ 12 11G16	○ 12 12	○ 15 12	◑ 300 15 9	◑ 300 15 9	◑ 300 15 8	◑ 300 15 6	○ 15 9	○ 15 10	○ 15 8	● 14 15 7	EXPLANATION OF HOURLY REPORTED WEATHER DATA BLOCKS SEE LEGEND AS AN EXAMPLE
3-3-84	SAT	⊕ 11 10 7	⊕ 14 10 10	⊕ 15 10 8	⊕ 18 10 9	⊕ 18 10 8	⊕ 20 10 9	⊕ 26 10 8	⊕ 13 10 8	⊕ 11 10 9	●● 15, 250 15 12	●● 18, 250 15 14G21	●● 21, 250 15 14	●● 28, 250 15 13	●● 32, 250 15 14G20	◑● 35, 250 15 14G20	◑● 40, 250 16 13G20	◑● 43, 250 15 13G25	◑● 43, 250 15 11G17	◑● 41, 250 15 12G18	◑● 37, 250 15 11	◑● 37, 250 15 12	◑● 37, 250 15 11G18	⊕ 10 15 11	⊕ 10 15 12	
3-4-84	SUN	⊕ 10 15 11	⊕⊕ 10, 35 10 8	⊕⊕ 7, 22 7 10	⊕⊕ 6, 14 7 12	⊕⊕ 6, 12 7 9	⊕⊕ 5, 14 7 7	◑⊕ 4, 22 3F 7	⊕ 6 4F 8	⊕⊕ 8, 15 6F 7G15	●● 12, 25 8 9G17	◑● 18, 85 10 12G19	◑● 20, 80 12 12G20	◑● 30, 85 12 11G18	●⊕ 33, 85 15 10G19	●● 35, 80 15 12	●● 32, 80 15 11	●⊕ 32, 75 15 12	◑● 32, 250 15 11	◑⊕ 28, 250 12 10	◑● 7, 43 9RW 17G25	◑● 7, 30 STRW 15G25	◑● 12, 27 12 13G23	⊕ 30 15 13G22	●⊕ 30, 250 3RW 16G24	
3-5-84	MON	⊕ 32 15 13	⊕ 32 15 20G27	⊕ 33 15 20	⊕ 35 15 15G23	⊕⊕ 24, 33 10R 19G26	⊕ 38 15 20G38	◑● 16, 38 15 21G30	●● 15, 38 15 22G32	⊕ 45 15 19	⊕ 45 15 16G23	⊕ 48 15 18G24	⊕ 48 16 19G26	● 45 15R 21	● 45 15 16	◑● 18, 50 15 17G24	◑● 19, 56 15 17G23	◑● 20, 56 15 16	◑● 21, 80 15 12G21	◑● 24, 70 15 12	● 45 15 8	● 48 15 8	● 56 16 8	● 55 15 9	◑ 70	
3-6-84	TUE	◑ 60 15 16	● 100 15 14	⊕ 80 15 13	⊕ 90 15 15	◑⊕ 60, 100 20 11	● 60 20 9	● 75 20 12	◑ 75 20 10	◑ 250 20 10	20 11	◑ 250 20 8	◑ 250 20 14	◑ 250 20 8G16	◑ 250 20 7G18	○ 20 11	○ 20 5	○ 20 8	○ 20 8	○ 20 6	○ 20 4	○ 20 5	○ 20 4	○ 20 4	○ 20 3	
3-7-84	WED	○ 20 5	○ 20 4	○ 20 5	○ 20 5	○ 20 6	○ 20 4	○ 20 7	○ 20 7	○ 20 10	○ 20 11	○ 20 13	○ 20 12	○ 20 11	○ 20 9	○ 20 5	○ 20 6	○ 20 5	○ 20 6	○ 20 4	○ 20 6	○ 20 4	○ 20 5	○ 20 6	○ 20 10	

LEGEND:

○	– SKY CONDITION (○ = CLEAR ◑ = SCATTERED ◍ = BROKEN ◒ = OVERCAST ● = X OBSCURE X PARTIALLY OBSCURED)
250	– CEILING HEIGHT (HEIGHT OF CLOUD LAYERS EXPRESSED IN HUNDREDS OF FEET AGL)
15	– VISIBILITY (EXPRESSED IN STATUTE MILES)
14G26	– WIND SPEED (EXPRESSED IN KNOTS, "G" INDICATES GUSTY)

SURFACE WEATHER OBSERVATIONS

ROBERT MUELLER MUNICIPAL AIRPORT - AUSTIN, TEXAS

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		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
3-8-84	THU	○ 20 8	○ 20 7	○ 20 6	○ 20 6	○ 20 4	○ 20 3	◑ 250 20 3	○ 20 0	○ 20 5	○ 20 14	○ 20 16G22	○ 20 15	○ 20 9	○ 20 8	◑◑ 60, 250 20 7	◑◑ 60, 250 20 7	◑◑ 60, 250 20 8	◑◑ 60, 250 20 9	◑◑ 50, 250 20 17	○ 20 13G22	○ 20 12G20	○ 20 8	○ 20 9	○ 20 12	
3-9-84	FRI	○ 20 12	○ 20 12	○ 20 13	◑ 40 20 14	◑ 24 20 10	◍ 27 20 8	● 29 20 9	◍ 29 20 11	◍ 30 20 10	◍ 30 20 8	◑ 35 20 8	◔ 40 20 7	◑ 40 20 11	◑ 45 20 11G18	◑ 50 20 10	◑ 55 20 9	◑ 55 20 9	◑ 50 20 9	◑ 45 20 8	○ 20 8	◍ 60 20 9	◔ 60 20 10	◑ 250 20 8	⊕ 38 15 9	
3-10-84	SAT	⊕ 26 15 8	◍⊕ 22, 43 15 7	◑ 22 15 6	⊕ 15 10 6	⊕ 14 10 8	⊕ 13 10 5	⊕ 11 10 4	◑◍ 11, 28 7 0	◑◑ 12, 60 7 3	◑◍ 8, 50 10 3	◍◍ 19, 60 12 8	◍⊕ 19, 37 15 3	⊕ 19 7 19	◑⊕ 28, 75 7 13G21	◑⊕ 18, 80 7 11	◑⊕ 43, 250 10 11	◑◍ 80, 250 10 10	◑◑ 80, 250 10 10	◍ 90 10 7	◍ 90 10 7	◑ 90 10 14	◑ 45 10 15	⊕ 43 10 9	◍⊕ 27, 28 10 8	◑⊕ 10, 24 10 8	EXPLANATION OF HOURLY REPORTED WEATHER DATA BLOCKS SEE LEGEND AS AN EXAMPLE
3-11-84	SUN	⊕ 9 10 9	● 9 10 9	⊕ 9 10 8	⊕ 7 7 6	⊕ 5 5 F 8	⊕ 4 5 F 7	● WX 1 3/4 F 5	● WX 1 3/8 L F 5	● WX 1 1/2 F 5	⊕ 2 1 F 6	⊕ 4 2 L F 8	⊕ 9 2½ R F 8	⊕ 11 4 F 9	⊕ 16 5 H 10	⊕ 17 5 R H 7	⊕ 18 5 H 7	⊕ 20 3 L H 9	⊕ 21 3 H 8	⊕ 18 3 7	⊕ 19 7 9	⊕ 17 10 13G20	⊕ 15 10 10	⊕ 11 10 12	⊕ 5 4 5	
3-12-84	MON	⊕ 3 2 TRW 8	●⊕ WIX, 7 1 TRW 16G24	⊕ 7 7 7G14	⊕ 3 2 TRW 11	⊕ 5 7 9	⊕ 5 7 5	⊕ 3 8 F 7	⊕ 3 2 3/4 F 7	⊕ 2 1 F 8	⊕ 5 1 F 8	◑◑ 10, 16 8 F 10	◔ 30 10 9	◑ 40 12 10	◑◔ 50, 250 15 7	◑ 50 15 10	◑ 50 15 9	◑◑ 50, 250 15 6	◑◑ 50, 250 15 9	◑ 50 15 7	○ 20 6	○ 20 8	○ 20 11	○ 20 11	○ 20 10	
3-13-84	TUE	○ 20 11	- 20 7	○ 20 8	○ 15 6	○ 10 5	○ 7 4	○ 3 F 5	●⊕ ·X, 4 2½ F 6	⊕● 3, W3X 3/4 F 6	● W2X 1/4 F 6	●⊕ W2X, 3 3/4, F 4	⊕ 6 2½ F 6	◔ 10 5 H 6	○ 6 H 7G14	● X 5 H 10	● ·X 6 H 10	◔ 300 7 11	○ 7 9	○ 10 6	○ 10 7	○ 10 7	○ 10 9	○ 10 8	○ 10 5	
3-14-84	WED	○ 10 3	⊕ 2 5 F 5	● WIX 1/4 F 9	⊕ 1 2 L F 12	⊕ 2 3 L F 7	◍⊕ 6, 20 3 F 6	⊕ 3 2 F 4	◑⊕ 3, 25 3 F 8	◑◑ 3, 25 3 F 8	◍⊕ 8, 20 8 9	⊕ 15 15 11	⊕ 13 15 9	⊕ 14 15 10	◔⊕ 21, 27 15 10	◑⊕ 27, 29 15 11	◑⊕ 15, 30 15 12	⊕ 12 10 12	⊕ 3 7 L 10	⊕● 2, X 2¼ L F 9	● WIX 2½ L F 7	◑⊕ 2, 4 6 FR 10	⊕● 2, X 3 L F 11G16	◑⊕ 2, 6 5 F 11	⊕ 7 10 10	

LEGEND

○ - SKY CONDITION (○ = CLEAR ◑ = SCATTERED ◍ = BROKEN ⊕ = OVERCAST ● = X OBSCURED; X PARTIALLY OBSCURED)
250 - CEILING HEIGHT (HEIGHT OF CLOUD LAYERS EXPRESSED IN HUNDREDS OF FEET AGL)
15 - VISIBILITY (EXPRESSED IN STATUTE MILES)
14G26 - WIND SPEED (EXPRESSED IN KNOTS, "G" INDICATES GUSTY)

SURFACE WEATHER OBSERVATIONS

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3-15-84	THU	⊕ 7 10 9	⊕ 7 10 8	⊕ 4 3 L F 8	⊕ 2 2¾ L-F 8	⊕ 1 2¾ L-F 6	⊕ 1 3 F 6	⊕ 3 5 R-F 10	⊕ 4 2¾ L-F 11	⊕ 4 3 F 12	⊕ 7 5 F 13	⊕ 10 4 L-F 11	⊕ 15 7 12G19	⊕ 15 2 L-F 11	⊕◑ 15, 38 3 F 9	⊕◑ 20, 50 7 13	⊕◑ 20, 50 7 12G17	◑⊕ 22, 55 7 10	⊕⊕ 55, 250 7 7	⊕ 55 7 4	◑⊕ 29, 48 7 4	◑⊕ 25, 45 7 7	⊕⊕ 14, 55 7 7	⊕ 12 7 9	⊕ 10 7 5	
3-16-84	FRI	⊕ 10 7 5	⊕ 9 7 4	⊕ 9 7 0	⊕ 9 7 4	⊕ 8 7 5	⊕ 8 5 L- 4	⊕ 3 3 R-F 7	⊕◑ 3, 15 3 R-F 8	◑◑ 3, 20 3 L-F 7	⊕ 2 1 R-L-F 9	⊕ 6 2 3/4 F 9	⊕◑ 17, 30 8 13G19	◑⊕ 20, 29 8 11G19	◑⊕ 23, 29 10 12G22	⊕◑ 32, 250 10 13G20	⊕◑ 32, 250 10 12G19	⊕ 35 10 10	⊕⊕ 48, 250 10 10	◑⊕ 48, 250 10 11	⊕ 250 10 12G17	◑ 250 10 12	⊕⊕ 10, 10 7 10	⊕ 10 7 9	⊕ 11 7 7	
3-17-84	SAT	⊕ 12 7 7	⊕ 11 7 12	⊕ 12 7 6	⊕ 16 7 5	⊕ 18 7 4	⊕ 18 7 4	⊕⊕ 15, 250 6 F 6	⊕◑ 9, 250 6 F 5	◑◑ 8, 220 5 F 6	◑◑ 10, 24 5 H 10	◑◑ 19, 30 8 7	◑ 26 9 8	◑ 26 9 6	⊕ 28 9 6	⊕ 29 9 7	◑ 33 15 6	⊕ 38 15 11	⊕ 41 15 11	⊕ 48 15 10	⊕⊕ 19, 50 15 9	◑⊕ 14, 50 15 13	◑◑ 7, 18 5 L- 10	⊕ 3 2¾ L-F 9	⊕ 14 7 11	EXPLANATION OF HOURLY REPORTED WEATHER DATA BLOCKS SEE LEGEND AS AN EXAMPLE
3-18-84	SUN	⊕ 11 7 11	⊕ 13 7 12	⊕ 15 7 10G18	⊕ 16 7 11	⊕ 16 7 7	⊕ 16 7 8	⊕◑ 16, 22 7 12	◑◑ 15, 24 8 13	⊕ 15 8 12G19	⊕◑ 21, 32 10 14G22	◑⊕ 27, 34 12 16G29	⊕ 34 15 17G32	◑ 40 15 18G30	◑ 42 15 14G23	◑ 44 12 13G26	⊕ 43 12 15G27	◑ 45 12 14G23	◑ 250 12 10G20	◑ 250 12 12G22	◑ 250 12 12G24	⊕◑ 17, 18 12 13G24	⊕ 15 12 14G22	◑⊕ 15, 90 3 TRW 13G22	◑⊕ 12, 250 12 7	
3-19-84	MON	⊕⊕ 100, 250 10 0	⊕ 100 3 TD 11	◑⊕ 120, 250 5 D 12	⊕ 140 7 14G21	◑⊕ 150, 250 10 13G20	◑ 140 10 15	◑ 140 12 16G25	◑◑ 140, 250 15 15G24	◑◑ 140, 250 15 17G25	◑◑ 140, 250 15 16G26	◑◑ 140, 250 15 17G25	○ 15 13G21	○ 15 18G27	○ 15 18G24	○ 15 18G25	○ 15 17G24	○ 15 17G30	○ 15 16G24	○ 15 14G22	○ 15 13	○ 15 9	○ 15 11	○ 15 8	○ 20 12	
3-20-84	TUE	○ 20 11	○ 20 9	○ 20 10	○ 20 7	○ 20 6	○ 20 8	○ 20 9	○ 20 9	○ 20 10	○ 20 10	○ 20 17	○ 20 13	○ 20 16G25	○ 20 12	○ 20 7	○ 20 10	○ 20 12G20	○ 20 9	○ 20 6	○ 20 6	○ 20 5	○ 20 4	○ 20 0	○ 20 0	
3-21-84	WED	○ 20 0	○ 20 5	○ 20 0	○ 20 4	○ 20 4	○ 20 5	○ 20 3	○ 20 3	○ 20 5	○ 20 7	○ 15 11	○ 15 12	○ 20 13	○ 20 16G21	○ 20 13	○ 20 12G19	○ 20 10G19	○ 20 10	○ 20 6	○ 20 9	○ 20 11	○ 20 11	○ 20 9	○ 20 7	

LEGEND:

○	= SKY CONDITION (○ = CLEAR ◑ = SCATTERED ◑ = BROKEN ⊕ = OVERCAST ⊗ = X OBSCURED; X PARTIALLY OBSCURED)
250	= CEILING HEIGHT (HEIGHT OF CLOUD LAYERS EXPRESSED IN HUNDREDS OF FEET AGL)
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3-22-84	THU	○ 20 8	◑ 18 15 6	◑ 250 15 5	◑◑ 20, 250 15 5	⊕ 18 15 4	⊕ 18 15 5	⊕ 20 15 5	● 24 15 5	◑◑ 10, 25 10 6	◑◑ 10, 25 10 7	●● 14, 25 8 12G18	⊕ 33 15 15G20	● 35 20 14G20	◑ 40 20 16G23	◑ 45 20 16G24	◍ 45 20 13G22	◑ 50 20 14	◑ 55 20 12G21	◍ 60 20 11	⊕ 60 20 13	⊕ 60 20 10	◑⊕ 26, 55 20 13	◑⊕ 22, 50 15 12G20	⊕⊕ 15, 30 15 11	
3-23-84	FRI	⊕ 12 6R 12	⊕ 12 8 7	⊕ 7 6 R 8	⊕ 4 5 F 9	⊕ 3 3 F 10	⊕ 3 3 RF 9	⊕ 2 1 RF 4	◑⊕ 2, 5 1 RF 4	◑⊕ 3, 7 1 F 4	◑⊕ 10, 10 7 R 6	◑◑ 30, 38 20 6	◑◑ 30, 38 20 5	◑◑ 40, 120 20 3	◑ 45 20 3	◑ 45 20 10	◑ 50 20 13	◑ 50 20 11	○ 20 11	○ 20 20	○ 20 16	◍ 80 20 13	◑ 80 20 14G23	◍ 80 20 7	◍ 80 20 9	EXPLANATION OF HOURLY REPORTED WEATHER DATA BLOCKS SEE LEGEND AS AN EXAMPLE
3-24-84	(SAT)	⊕ 90 20 13	◑⊕ 40, 90 15 11	◍ 90 15 8	⊕ 80 15 17	◍⊕ 75, 120 15 10	◑⊕ 75, 250 15 9	◑◑ 120, 250 15 11	◑◑ 120, 250 15 11	○ 15 12	○ 20 13	○ 20 6	○ 20 7	○ 20 10	○ 20 12	○ 20 12	○ 20 13	○ 20 9	○ 20 10	○ 20 8	○ 20 8	○ 20 5	○ 20 3	○ 20 3	○ 20 0	
3-25-84	SUN	○ 20 0	○ 20 0	○ 20 0	○ 20 4	○ 20 0	◑ 250 15 0	◍ 250 15 0	◍ 250 15 0	◍ 250 15 4	◍ 250 15 7	◍ 250 15 11	⊕ 250 15 13	⊕ 250 15 7G15	⊕ 250 15 12	◍ 250 15 13G18	◍ 250 15 13	◑◑ 160, 250 15 12	◑◑ 160, 250 15 10	◑⊕ 160, 250 15 8	⊕ 250 15 9	◑ 250 15 11	⊕ 250 15 9	⊕ 160 15 9	⊕ 140 15 8	
3-26-84	MON	⊕ 120 15 11	◑⊕ 24, 120 15 9	◑⊕ 22, 120 15 8	◑⊕ 17, 24 15 9	⊕ 11 12 7	⊕ 9 11 8	⊕ 9 11 8	⊕ 9 7 12	⊕ 3 1 L-F 10	⊕ 2 2 F 6	⊕ 7 7 8	◑⊕ 14, 250 7 10	◑⊕ 17, 250 10 11	⊕ 250 10 9	◑⊕ 150, 250 10 7	◑⊕ 150, 250 12 6	◑⊕ 150, 250 15 9	◑ 250 15 8	◑ 250 12 5	◑ 250 12 8	◑ 250 12 7	◑ 250 12 7	◑ 250 12 10	◑◑ 13, 250 10 8	
3-27-84	TUE	◑◑ 10, 250 9 10	◑⊕ 7, 6 5 F 8	⊕ 5 6 F 12	⊕ 6 6 F 10	⊕ 7 6 F 8	⊕ 10 6 F 10	●⊕ -X, 14 3 F 13	●⊕ -X, 15 3 FH 8G17	●⊕ -X, 12 4 H 11G17	◑ 15 6 H 12G17	○ 6 H 10	○ 6 H 13G17	◑ 310 6 H 13G19	◑ 310 10 20G34	◑ 310 15 13	○ 15 12	○ 60 15 18G31	◑ 60 15 10	◑ 90 15 14G28	◑ 90 6 D 17G25	◑ 90 5 D 16G25	● X 4 D 25G42	● X 6 D 20G39	● X 7 16G31	
3-28-84	WED	○ 20 14G25	○ 20 16G26	○ 20 18G27	○ 20 23G34	◑ 15 15 19G31	○ 20 30G44	○ 20 28G37	○ 20 25G34	○ 20 29G37	○ 20 30G40	○ 20 30G40	◔ 20 23G35	○ 20 23G34	○ 20 20G29	○ 20 22G35	○ 20 19G30	○ 20 12	○ 20 13	○ 20 11	○ 20 14	○ 20 8	◔ 20 8	○ 20 8	○ 20 8	

LEGEND:

○	= SKY CONDITION (○ = CLEAR ◑ = SCATTERED ◍ = BROKEN ● = OVERCAST ⊕ = X OBSCURED; -X PARTIALLY OBSCURED)
250	= CEILING HEIGHT (HEIGHT OF CLOUD LAYERS EXPRESSED IN HUNDREDS OF FEET AGL)
15	= VISIBILITY (EXPRESSED IN STATUTE MILES)
14G28	= WIND SPEED (EXPRESSED IN KNOTS, "G" INDICATES GUSTY)

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3-29-84	THU	○ 20 11	○ 20 12	○ 20 10G18	○ 20 15	○ 20 14	○ 20 12	○ 20 7	○ 20 13	○ 20 12	○ 20 15	○ 20 10	○ 20 8	○ 20 10	○ 20 8G18	○ 20 8	○ 20 10	○ 20 8	○ 20 7	○ 20 7	○ 20 6	○ 20 7	○ 20 7	◑ 140 20 9	◍ 140 20 6	EXPLANATION OF HOURLY REPORTED WEATHER DATA BLOCKS SEE LEGEND AS AN EXAMPLE
3-30-84	FRI	◑ 140 20 5	⊕ 140 20 3	⊕ 140 20 5	⊕ 120 20 6	◑ 120 20 6	◑ 100 20 7	◑◑ 100, 250 6 R- 8	◍⊕ 55, 100 6 H 9	◑ 80 10 8	◑ 100 10 10	○ 10 9	○ 12 10	○ 12 7G16	○ 12 10	◑ 250 15 7	◑ 250 15 10	◑ 250 20 12	○ 20 8	○ 20 6	○ 20 6	○ 20 5	○ 20 7	○ 20 7	○ 20 9	
3-31-84	SAT	○ 15 7	○ 7 4	○ 2½ F 3	◍⊕ 10, 6 2½ F 4	⊕ 4 2½ F 4	● 2 2½ F 3	● W2X 1½ F 9	● W1X 1 7	●⊕ 3 1 3/4 F 5	● -X, 5 2 1/4 F 5	●⊕ -X, 7 2 1/2 F 5	●⊕ -X, 9 2 1/2 F 5	⊕ 10 4H 4	◍ 11 4H 5	◍ 14 5H 4	● 22 7 7	◑ 30 7 5	◑ 45 15 7	◍ 45 15 10	○ 15 6	◑ 50 12 5	◑ 35 10 6	◍ 28 8 11G20	⊕ 28 8 10	

LEGEND:

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250 → CEILING HEIGHT (HEIGHT OF CLOUD LAYERS EXPRESSED IN HUNDREDS OF FEET AGL)
15 → VISIBILITY (EXPRESSED IN STATUTE MILES)
14G26 → WIND SPEED (EXPRESSED IN KNOTS, "G" INDICATES GUSTY)

SURFACE WEATHER OBSERVATIONS

PORT COLUMBUS INTERNATIONAL AIRPORT - COLUMBUS, OHIO

PRE ARSA

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		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
11-8-83	TUE	○ 15 3	○ 15 3	○ 15 3	○ 15 3	○ 15 3	○ 15 0	○ 12 0	○ 12 4	○ 10 3	○ 10 5	○ 10 5	○ 10 7	○ 10 7	◑ 250 10 5	◑ 250 10 6	◑ 250 15 6	◑ 250 15 6	○ 15 5	○ 15 5	○ 15 3	○ 15 3	○ 15 0	○ 15 4	○ 15 0	
11-9-83	WED	○ 15 0	○ 15 0	○ 15 4	○ 15 3	○ 15 3	○ 15 3	◑ 250 12 0	◑ 250 12 0	◑ 250 8 0	◑ 250 4 4	◑ 250 10 8	◑ 250 10 6	● 250 10 8	● 250 10 7	◑ 250 10 10	● 250 15 9	● 250 15 5	● 250 15 5	◑ 250 15 8	◑ 250 15 7	◑ 250 15 7	◑◑ 40, 250 15 6	◑◑ 70, 250 15 7	◑ 70 15 8	
11-10-83	THU	○ 15 4	○ 12 6	○ 12 9	⊕ 100 12 7	◑⊕ 30, 100 12 6	◑⊕ 50, 100 15 8	◑⊕ 60, 100 12 7	◑⊕ 11, 75 7 6	●⊕ 8, 15 5 R-F 7	●⊕ 6, 11 2¼ R-F 9	⊕ 7 1 R-F 11	●● 7, 20 1 R-F 10	● 7 2¼ R-F 11	⊕ 8 3 R-F 9	● 7 1 R-F 12	●⊕ 9, 28 1 R-F 4	◑⊕ 8, 25 1 R-F 4	⊕ 8 1 R-F 20	◑⊕ 10, 30 4 R-F 15	⊕ 40 7 R- 9	⊕ 50 7 R- 6	◑⊕ 10, 25 7 R- 18G26	● 11 7 R- 14	⊕ 8 7 R- 12	EXPLANATION OF HOURLY REPORTED WEATHER DATA BLOCKS SEE LEGEND AS AN EXAMPLE
11-11-83	FRI	⊕ 8 10 11	⊕ 9 9 L- 11	◑⊕ 8, 14 5 R- L- 3	⊕ 7 4 R- L- 10	⊕ 7 4 L- 8	⊕ 7 4 R- L- 10	⊕ 8 4 R- 11	◑⊕ 10, 30 7 R- 14G20	⊕ 10 10 R- 13G21	⊕ 12 10 R- 14G21	● W4X 3/4 S-F 14G26	● W2X 1/2 S-F 15G22	● W3X 3/4 S-F 13G22	⊕ 8 4 S-F	●⊕ -X, 10 2 S- 18G27	⊕ 17 ≥ S- 18G25	⊕ 21 6 S- 15G24	⊕ 25 7 14G23	⊕ 25 7 S- 17	⊕ 25 7 S- 14	⊕ 28 7 S- 15	⊕ 28 7 12G22	⊕ 32 7 14	⊕ 32 7 10	
11-12-83	SAT	⊕ 35 15 12	⊕ 41 15 12	◑ 45 15 11	◑ 45 15 9	⊕ 35 15 9	◑ 30 15 11	○ 15 10	○ 15 9	◑ 250 15 12	◑ 250 15 13	◑ 250 15 10	○ 15 12	○ 15 10	◑ 250 15 9	◑ 250 15 10	● 250 15 10	● 250 15 7	◑ 250 15 6	● 250 15 5	● 250 15 5	◑ 250 15 4	◑ 250 15 5	◑ 250 15 4	◑ 250 15 4	
11-13-83	SUN	◑◑ 100, 250 15 4	◑⊕ 100, 250 15 3	◑ 250 12 5	◑ 250 12 4	◑ 250 12 3	⊕⊕ 100, 250 12 0	●● 100, 250 12 0	◑● 100, 250 12 3	⊕ 200 15 4	⊕ 200 15 7	⊕ 200 15 9	◑⊕ 27, 200 15 7	◑● 28, 200 15 8	◑⊕ 30, 250 15 6	◑⊕ 30, 200 15 5	◑⊕ 30, 250 15 5	◑⊕ 30, 250 15 5	◑⊕ 32 15 5	⊕ 32, 250 15 5	◑◑ 35,250 15 0	○ 15 4	○ 15 4	○ 10 0	○ 10 4	
11-14-83	MON	○ 7 0	○ 7 0	○ 7 0	○ 7 0	○ 7 0	○ 7 0	◑ 200 7 0	◑● 120, 200 5 H 4	◑◑ 120, 250 7 5	⊕ 200 10 6	● 200 15 7	○ 15 10	○ 250 15 10	● 250 15 12	◑⊕ 90, 250 15 10	◑⊕ 90, 250 15 10	●● 90, 250 10 8	●⊕ 90, 250 10 7	⊕ 90 10 10	⊕ 90 10 9	⊕ 90 10 6	◑ 90 10 7	⊕ 90 10 7	◑ 90 10 10	

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3-15-84	THU	◐ 250 3H 9	◐ 250 3H 9	◍ 250 3H 7	◐ 250 3H 6	◐◐ 90, 250 3H 7	◐◐ 80, 250 3H 8	◐◐ 75, 250 3H 7	◐◐ 110, 250 3H 8	◐⊕ 90, 250 3H 10	⊕ 90 3RWH 8	⊕ 45 3RWH 10	◐⊕ 50, 80 5H 12	◐⊕ 55, 90 5H 16	◐⊕ 50, 120 6H 8	◐⊕ 35, 120 7 7	◐⊕ 50, 200 7 8	◐⊕ 100, 200 8 9	◐⊕ 70, 100 7 7	◐⊕ 70, 250 7 8	◐◐ 100, 250 8 9	◐◐ 100, 250 12 8	◐⊕ 50, 90 10 9	◐⊕ 90, 120 10 10	◐⊕ 80, 120 12 10	
3-16-84	FRI	◐⊕ 30, 75 7RW- 15	◐⊕ 30, 65 7R- 13	◐⊕ 17, 30 7R- 18	⊕ 17 7R- 18G25	⊕ 25 6RW- 18G25	⊕ 10 5RW- 18G25	⊕ 7 7 17G27	◐⊕ 7, 10 5RW- 15G21	⊕ 9 6H - 14	⊕ 12 7 15	⊕ 18 12 17G25	⊕ 15 12 20G26	⊕ 19 12 19	⊕ 19 12 17	⊕ 20 12 15	⊕ 16 10 16	⊕ 16 7 18	⊕ 17 7 10	⊕ 17 7 10	⊕ 16 7 15	⊕ 15 7 13	⊕ 14 7 11	⊕ 13 7 13G21	⊕ 11 7 11	
3-17-84	SAT	⊕ 10 7 11	⊕ 10 7 11	⊕ 11 7 7	⊕ 11 7 9	⊕ 11 7 9	⊕ 10 7 6	⊕ 12 7 10	⊕ 12 5H 11	⊕ 11 5H 11	⊕ 13 5H 7	⊕ 13 5H 10	⊕ 16 5H 12	⊕ 17 5H 13	◐⊕ 20, 100 5H 8	◐⊕ 20, 100 5H 12	◐⊕ 20, 100 6H 9	◐⊕ 20, 100 7 9	◐⊕ 50, 90 7 6	◐⊕ 40, 75 7 10	◐⊕ 40, 75 7IP- 10	⊕ 55 7R- 8G18	⊕ 41 7R- 7	⊕ 32 4R- 9	⊕ 28 5H 5	EXPLANATION OF HOURLY REPORTED WEATHER DATA BLOCKS SEE LEGEND AS AN EXAMPLE
3-18-84	SUN	⊕ 25 5H 4	⊕ 23 5H 4	⊕ 22 5H 3	⊕ 22 5H 5	⊕ 17 4FH 3	⊕ 18 4FH 6	⊕ 18 2½FH 6	⊕ 5 2½FH 8	⊕ 5 2½FH 10	⊕ 5 2½FH 9	⊕ 6 2½FH 9	⊕ 6 2½FH 8	⊕ 7 2½FH 8	⊕ 8 2½FH 7	⊕ 7 2½FH 8	⊕ 8 2½H 9	⊕ 10 3H 11	⊕ 10 3H 10	⊕ 10 3H 9	⊕ 11 3H 9	⊕ 12 4H 6	⊕ 13 4H 6	◐⊕ 11, 17 4H 8	⊕ 10 4H 6	
3-19-84	MON	⊕ 10 4H 6	⊕ 11 4H 8	⊕ 10 4H 7	⊕ 10 4H 5	⊕ 10 4H 6	◐⊕ 10, 14 4H 9	◐⊕ 8, 14 4H 4	◐⊕ 7, 14 2½H 6	◐⊕ 7, 11 1½H 8	◐⊕ 7, 11 1½H 6	⊕ 7 1½RW- 5	⊕ 8 2½RW- 5	◐⊕ 13, 40 3H 9	◐⊕ 15, 50 3H 8	◐◐ 15, 50 3H 6	◐◐ 100, 250 5H 12	◐ 250 6H 13	◐ 250 6H 10	◍ 250 6H 9	◐ 250 6H 9	◐ 250 6H 10	◍ 250 6H 12	◐⊖ 110, 250 6H 12	◐⊕ 130, 250 7 10	
3-20-84	TUE	◐⊖ 65, 250 7 12	◐◐ 130, 250 7 12	◐◐ 130, 250 7 8	◐⊖ 65, 250 7 12	◐⊕ 55, 80 7 11	◐⊖ 65, 250 7 12	◐⊕ 55, 200 7 0	◐⊕ 100, 250 7 7	◐⊕ 40, 250 7 6	◐⊕ 50, 100 7 5	◐⊕ 45, 100 7 11	◐⊕ 25, 100 2½RW- 9	◐⊖ 25, 100 3RW- 7	◐⊕ 25, 45 3RW- 20	⊕ 26 3RW- 16	◐⊕ 10, 26 4R-F 16	◐⊕ 10, 20 4R-F 7	◐⊕ 15, 60 4R-F 7	◐⊕ 5, 35 2½R-F 6	◐⊕ 5, 30 4R-F 3	◐⊕ 6, 15 4R-F 5	◐⊕ 2, 10 1/2RF 3	◐⊕ 3, 15 4F-F 20	◐⊕ 6, 8 5R-F 12	
3-21-84	WED	⊕ 14V 5R-F 12	◐⊕ 18, 26 5R-F 13	◐⊕ 12, 28 5R-SF 12	⊕ 6 5S-F 11	⊕ 5 2S-F 10	⊕ 10 4SWF 10	⊕ 12 5SW- 14G19	⊕ 9 5SW 13	⊕ 10 1½SW 16	⊕ 12 1½SW- 14	◐⊕ 10, 50 1½SW 13	◐⊕ 12, 50 7 18	⊕ 12 2SW- 20	◐⊕ 10, 90 1½SW 16	◐⊕ 20, 90 1SW 24	●⊕ 6, 70 1/2SW 13	◐⊕ 10, 45 1/2SW 17G23	◐⊕ 14, 45 1½SW 18G27	◐⊕ 10, 15 2S- 18G25	◐⊕ 11, 14 2SW- 18G26	◐⊕ 10, 13 5 18G27	◐⊕ 10, 15 5 18G27	◐⊕ 11, 16 5 18G27	◐⊕ 10, 15 5 18G27	

LEGEND:

○	= SKY CONDITION (○ = CLEAR ◐ = SCATTERED ◍ = BROKEN ● = OVERCAST ⊗ = X OBSCURED; ⊖ = X PARTIALLY OBSCURED)
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3-22-84	THU	⊕ 12 4S- 20G27	⊕ 10 4S- 19G26	⊕ 11 4S- 18G27	⊕ 14 4R S- 21G29	⊕ 10 1¼S- 17G26	⊕ 10 1¼S- 15G27	⊕ 12 SS- 18	⊕ 10 5S- 18G28	⊕⊖ 17, 38 7S- 17G28	●⊕ 10, 38 1S- 20G27	◐⊕ 15, 25 10SW- 17G24	◐⊕ 15, 25 8SW- 16G27	◐⊕ 15, 25 3S- 17G24	◐⊕ 15, 28 7S- 18G29	◐⊕ 15, 28 5S- 20G27	◐⊕ 15, 25 10 18G24	◐⊕ 15, 35 2SW- 18	◐⊕ 16, 35 5SW- 19	◐⊕ 14, 35 2½SW- 17G23	◐⊕ 13, 25 5SW- 16G27	◐⊕ 15, 30 4S- 13	◐⊕ 15, 35 4S- 13G23	◐⊕ 20, 50 10 18	◐⊕ 20, 38 10SW- 18G25	
3-23-84	FRI	◑⊕ 22, 38 7 13	◑⊕ 20, 32 7SW- 13	◑⊕ 22, 35 7SW- 13	◑⊕ 22, 38 10 16G24	◑⊕ 25, 38 10 11G16	◑⊕ 25, 35 10 16G23	◑ 23 10 12	◑ 32 10 13	◑ 30 15 15	◑ 30 15 16	◑ 30 15 11G20	◑ 35 15 13	◑ 35 15 14G21	○ 15 12	○ 15 10G27	○ 15 12	○ 15 11	○ 15 7	○ 15 7	○ 15 5	○ 15 6	○ 15 3	○ 15 4	○ 15 3	EXPLANATION OF HOURLY REPORTED WEATHER DATA BLOCKS SEE LEGEND AS AN EXAMPLE
3-24-84	SAT	○ 15 3	○ 12 3	○ 12 3	◕ 200 7 4	◑ 150 7 3	◑ 150 10 4	◑◑ 150, 250 10 5	◑◑ 120, 250 7 3	◍⊕ 120, 250 10 7	◑⊕ 80, 120 10 6	◑⊕ 80, 120 10 7	◑⊕ 80, 120 10 6	◑⊕ 70, 90 10 5	◑⊕ 90, 250 10 7	◑⊕ 90, 250 10 10	◑⊕ 80, 120 10R- 8	⊕ 75 10R- 8	◑⊕ 65, 110 10R- 6	⊕ 100 10 6	⊕ 80 10 8	⊕ 85 10 7	⊕ 85 10 6	⊕ 75 10R- 10	⊕ 75 10 8	
3-25-84	SUN	⊖ 65 10R- 4	⊕ 55 7R- 6	⊕ 55 7R- 8	⊕ 65 7R- 13	⊕ 65 10 7	⊕ 65 10 7	◑⊕ 85, 120 10 11	◍⊕ 55, 120 10 10	◑⊕ 50, 90 12 11	⊕ 50 10RW- 8	⊕ 50 10RW- 7	⊕ 41 8R- 6	⊕ 38 3R-H 8	⊕ 25 2½R-H 8	◍⊕ 20, 30 2½R-H 12G21	⊕ 23 4R-H 5	⊕ 26 6H 7	⊕ 32 5R- 9	⊕ 32 2½R-F 9	⊕ 38 4R-F 13	⊕ 38 4R-F 12	⊕ 41 7R- 12	⊕ 38 10 9	⊕ 41 10 9	
3-26-84	MON	⊖ 41 10 9	⊕ 45 10 8	◑ 50 10 9	◑ 50 10 5	○ 10 8	○ 10 6	○ 12 4	○ 10 7	○ 10 9	◑ 250 12 8	◑ 250 12 4	◍ 250 12 7	◑ 250 12 8	⊕ 250 15 6	⊕ 250 15 6	⊕ 250 15 4	⊕ 250 12 5	⊕ 250 12 5	⊕ 250 12 8	⊕ 250 12 8	⊖ 220 12 7	⊕ 200 12 7	⊕ 200 12 5	⊕ 200 12 8	
3-27-84	TUE	◑◑ 100, 250 15 4	◍◍ 140, 250 12 10	⊕ 100 12 10	⊖ 100 12 9	◑⊕ 55, 100 12 8	◑⊕ 50, 100 10 5	◑⊕ 90, 250 8 8	◑⊕ 50, 250 7 7	◑⊕ 30, 55 7RW- 8	◑⊕ 55, 80 7 6	◑● 35, 55 7RW- 5	◑⊕ 35, 55 7RW- 8	◑⊕ 35, 55 7 8	⊕ 50 7 9	⊕ 45 7 8	⊕ 45 7 8	⊕ 38 7 7	⊕ 32 7 8	⊕ 28 7 4	⊕ 26 7 12	◍⊕ 26, 35 10 11	◑⊕ 35, 120 10 8	◑◐ 23, 35 10 7	◍⊕ 25, 120 10 6	
3-28-84	WED	◑⊖ 25, 100 10 6	◑◑ 25, 100 10 7	◑⊕ 20, 100 10 7	⊕ 30 8 7	◑⊕ 9, 26 8 10	◑⊕ 9, 90 8 9	◑⊕ 11, 90 6H 9	◑⊕ 10, 23 5H 10	◑⊕ 10, 55 5H 10	◑⊕ 10, 38 7RW- 13	◑⊕ 10, 45 7RW- 11	◑⊕ 10, 55 6R- 16G23	●⊕ 13, 55 6R- 15	⊕ 11 2½R-F 14G23	⊕ 11 2½R-F 14G21	⊕ 11 2½R-F 13	⊕ 13 3R-F 18G24	⊕ 16 8 16G23	⊕ 18 8 16G24	⊕ 20 8R- 16G26	⊕ 19 10R- 18G29	⊕ 16 7R- 18	⊕ 18 8R- 18G27	⊕ 16 5R- 15G27	

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LEGEND:

○	SKY CONDITION (○ = CLEAR ◑ = SCATTERED ◍ = BROKEN ⊕ = OVERCAST ● = X OBSCURED; ◔ = X PARTIALLY OBSCURED)
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3-29-84	THU	● 11 5R- 16G23	◐ 10 5R- 17	● 10 5R- 14G22	● 10 6R- 14	●● -X, 9 2S- 13G22	● W3X 1S- 16	● 6 1S-F 11	● 14 7 13	● 13 10 18	● 14 10 15G25	● 13 10 17G23	● 16 12 15G24	● 15 12 17G27	● 17 12 20G27	● 22 12 16G24	●● 26, 70 12 16	◐● 25, 70 10 13	●● 28, 75 10 8	●● 28, 200 10 5	●● 55, 90 10 4	◐◐ 50, 65 10 7	● 65 10 5	● 65 10 7	● 65 10 5		
3-30-84	FRI	● 65 10 5	● 65 10 7	◐ 65 10 4	◐ 65 10 7	● 65 10 4	○ 10 4	◐ 80 10 5	● 80 7 10	● 65 12 9	● 65 12 11	◐● 30, 65 16 12	◐● 30, 65 15 14	◐● 30, 80 15 15	◐● 35, 60 15 13	◐● 35, 55 15 14	●● 32, 55 10 SW- 5	◐◐ 35, 65 10 10	◐◐ 35, 65 10 11	◐● 35, 55 10 8	◐● 20, 55 10 12	◐◐ 30, 55 10 10	◐◐ 10, 55 7RW 8	◐● 20, 55 10 9	◐● 20, 55 10 9		
3-31-84	SAT	◐ 30 10 11	● 22 10 9	○ 10 7	◐ 20 10 9	◐ 25 12 6	◐ 25 12 5	◐ 200 12 4	● 200 8 7	● 200 10 8	● 200 10 8	◐ 200 10 8	◐ 200 12 9	● 41 12 8	●● 41, 200 12 11	◐● 45, 200 15 7	◐◐ 50, 200 15 10	◐◐ 50, 200 15 9	● 55 15 11	● 55 15 11	● 50 15 9	● 50 15 10	◐◐ 50, 200 15 7	● 200 15 9	● 200 15 5		
4-1-84	SUN	◐ 250 15 0	●◐ 55, 250 15 0	◐ 50 10 0	● 55 10 3	● 55 10 0	◐ 55 10 0	○ 5F 3	○ 5H 4	○ 7 6	○ 10 10	○ 10 13G19	○ 12 14G20	○ 12 13G18	○ 15 15	○ 15 13	○ 15 13	◐ 50 15 14	◐ 50 15 8	◐ 50 15 9	◐ 50 15 8	○ 15 6	◐ 65 15 3	◐ 65 10 0	○ 10 4		EXPLANATION OF HOURLY REPORTED WEATHER DATA BLOCKS SEE LEGEND AS AN EXAMPLE
4-2-84	MON	○ 10 3	○ 7 4	○ 7 0	○ 7 0	○ 7 4	○ 7 4	◐ 250 7 3	◐ 250 5H 5	● 220 5H 5	● 220 6H 5	◐● 140, 220 10 9	◐● 50, 140 12 11	◐● 56, 140 12 12	◐● 56, 120 12 10G17	◐● 55, 120 15 11	● 100 15 9	● 90 15 7	●● 90, 200 15 11	● 90 15 8	● 90 15 6	●● 90, 200 12 8	●● 90, 200 12 6	● 110 12 4	●● 65, 110 10 4		
4-3-84	TUE	● 120 7 5	◐ 120 7 5	◐ 120 7 5	○ 7 10	◐ 120 7 12	◐ 120 7 11	◐◐ 120, 250 7 10	◐● 120, 200 7 10	●● 120, 220 7 14G21	◐● 120, 220 10 17G23	●● 120, 220 10 15G21	●● 120, 220 12 15	● 90 12 16	●● 55, 90 7R- 12	● 45 5R- 11	● 35 2½R- 8	◐● 35, 50 2½R-F 10	●● 40, 40 5R-F 7	◐● 10, 20 5L-F 8	◐● 10, 20 5 L-F 9	● 21 7 9	◐● 10, 21 7 13	◐● 20, 32 7 10	◐● 8, 25 7 8		
4-4-84	WED	◐● 25, 35 7 8	◐● 20, 35 5F 4	●● 20, 35 5F 4	● 23 6F 7	◐◐ 25, 40 6F 8	●● 27, 60 7 6	◐● 30, 60 7 11	◐● 30, 60 7 8	●● 35, 120 7 9	●● 38, 120 7RW 7	◐● 45, 120 7 9	●● 20, 32 2RWF 8	◐● 18, 45 2½RWF 10	◐● 12, 50 2½RF 9	◐● 14, 25 2RW F 8	● 12 2RW-F 8	◐● 10, 20 2RW-F 10	● 10 2RW-F 10	● 9 4F 10	●● 6, 13 5R-F 6	● 5 2R-F 4	● 4 2R-F 3	◐● 5, 10 5F 0	● 4 1½R-F 4		

LEGEND:

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DATE	DAY	LOCAL STANDARD TIME: HOUR																								REMARKS
		00	01	02	03	04	05	6	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
4 5 84	THU	⊕ 4 1R F 0	● W1X 1/2 R F 5	● 2 1/2F 9	⊕ 3 1¼F 8	⊕ 3 5L F 9	⊕ 4 5L F 6	⊕ 5V 4L-F 6	⊕ 4 2½L-F 7	⊕ 4 1¼L F 6	⊕ 6 1¼L F 8	●⊕ 8, 14 3L F 9	⊕ 9V 5R F 9	◑⊕ 9, 16 5R-F 12	◑⊕ 10, 17 5R F 16	◑⊕ 14, 22 6R- 12	◑⊕ 14, 22 6R- 12	⊕ 11 6L- 8	●⊕ 11, 20 6R-L- 7	⊕ 7 7R- 12	⊕ 11, 25 7R- 14	●⊕ 6, 15 7R- 10	⊕ 8 6R- 8	◑⊕ 6, 12 6R- 10	◑⊕ 8, 15 5R- 10	
4 6 84	FRI	◑⊕ 8, 12 6R 12	◑⊕ 9, 12 7R- 11	⊕ 11 4R F 13G21	◑⊕ 11, 20 6R F 13	◑⊕ 11, 17 10R- 14	◑⊕ 16, 30 10 14	⊕ 16 10RW- 15	⊕ 10 5RW- 13	⊕ 12 6RW- 13	⊕ 14 7L 14	⊕ 15 7L 13	◑⊕ 15, 30 7L- 15	◑⊕ 15, 25 7L- 13	◑⊕ 18, 38 7 14G26	◑⊕ 19, 35 7 14G20	◑⊕ 19, 30 7 14	◑⊕ 21, 30 7 16	⊕ 20 8 14	◑⊕ 20, 28 8 12	⊕ 20, 30 8 13	⊕ 19 8 10	⊕ 11 5S- 9	⊕ 8 4L-S- 10	⊕ 10 5L- 12	EXPLANATION OF HOURLY REPORTED WEATHER DATA BLOCKS SEE LEGEND AS AN EXAMPLE
4 7 84	SAT	◑⊕ 12, 50 8 7	◑⊕ 15, 55 10 10	◑ 15 10 8	○ 10 7	○ 15 7	○ 15 6	○ 12 6	○ 15 8	○ 15 11	○ 15 10	◑ 250 15 8	◑ 250 16 12	◑ 250 15 13	◑◑ 25, 250 20 12G19	◑◑ 35, 250 20 14	◑◑ 38, 250 20 13	◑◑ 38, 250 15 12	◑◑ 38, 250 15 16	◑ 250 15 15	○ 15 8	○ 15 10	○ 15 14	○ 15 12	○ 15 5	
4 8 84	SUN	◑ 250 15 7	◑ 250 15 5	◑ 250 15 5	○ 15 3	◑ 250 15 3	◑ 250 15 3	⊕ 250 12 3	⊕ 250 15 5	◑⊕ 140, 250 15 7	◑⊕ 140, 250 15 8	◑⊕ 140, 250 15 9	◑⊕ 120, 250 16 9	◑⊕ 120, 250 15 12	◑⊕ 120, 250 15 13	◑⊕ 120, 250 15 12	◑⊕ 120, 250 15 11	◑⊕ 120, 250 15 14	◑⊕ 100, 250 15 12	◑⊕ 90, 250 15 10	◑⊕ 90, 250 15 10	⊕ 65 15 10	⊕ 65 10 6	⊕ 65 10 10	⊕ 90 10 15	
4 9 84	MON	◑⊕ 90, 250 15 15	⊕ 90 15 17G23	⊕ 80 15 13	⊕ 75 15 16	◑⊕ 40, 65 15RW- 16	◑⊕ 60, 80 15 14G22	◑⊕ 70, 100 15 12	◑⊕ 75, 110 15 14G21	◑⊕ 5, 120 15 12G20	◑⊕ 75, 120 15 14G21	◑⊕ 65, 120 15 13	◑⊕ 70, 120 12 12	◑⊕ 65, 120 15 13	◑⊕ 75, 150 15 13	◑⊕ 55, 150 15 14	◑⊕ 55, 150 15 12	◑⊕ 55, 150 15 9	●⊕ 55, 150 15 8	◑⊕ 55, 150 15 6	◑⊕ 60, 250 15 8	◑ 250 10 9	○ 10 13	○ 10 13	○ 10 9	
4 10 84	TUE	◑ 250 15 10	◑ 250 15 10	◑ 250 15 11	◑ 250 15 12	◑ 250 15 7	◑◑ 120, 250 15 10	●● 120, 250 15 11	◑● 80, 250 15 11	◑● 80, 250 15 12	◑ 250 20 12	◑ 250 20 13	◑ 250 20 13	◑ 250 15 8	○ 15 10	○ 15 15	○ 15 15	○ 15 13	○ 15 12	○ 15 12	○ 15 11	○ 15 11	○ 15 10	○ 15 7	○ 15 9	
4 11 84	WED	○ 15 5	○ 15 6	○ 15 5	○ 15 4	○ 15 4	○ 15 5	○ 15 5	○ 15 8	○ 15 8	○ 15 8	○ 15 7	○ 15 8	○ 15 4	○ 15 7	○ 15 9	◑ 250 15 5	◑ 250 15 4	◑ 250 15 5	◑ 250 15 5	○ 15 10	○ 15 7	○ 15 8	○ 15 5	○ 15 5	

LEGEND:

○ – SKY CONDITION (○ = CLEAR ◑ = SCATTERED ● = BROKEN ⊕ = OVERCAST ● = X OBSCURED; ◑ X PARTIALLY OBSCURED)
250 – CEILING HEIGHT (HEIGHT OF CLOUD LAYERS EXPRESSED IN HUNDREDS OF FEET AGL)
15 – VISIBILITY (EXPRESSED IN STATUTE MILES)
14G26 – WIND SPEED (EXPRESSED IN KNOTS, "G" INDICATES GUSTY)

SURFACE WEATHER OBSERVATIONS

PORT COLUMBUS INTERNATIONAL AIRPORT - COLUMBUS, OHIO

POST-ARSA

DATE	DAY	LOCAL STANDARD TIME: HOUR																								REMARKS
		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
4-12-84	THU	○ 15 6	○ 15 9	◑ 250 15 5	◑ 250 15 5	◑ 250 15 5	● 250 15 6	● 250 15 6	⊕ 250 12 8	● 250 15 7	● 250 12 7	● 250 12 8	● 250 10 10	● 250 10 11	⊕ 250 10 11	◑⊕ 140, 250 10 10	◑⊕ 140, 250 10 8	◑⊕ 50, 250 10 12	◑⊕ 50, 250 10 9	◑⊕ 50, 140 10 6	◑⊕ 50, 120 10 7	◑⊕ 50, 90 10 8	◑⊕ 50, 90 10 8	⊕ 55 10RW- 11	⊕ 65 10RW- 8	
4-13-84	FRI	◑⊖ 23, 65 5RW- 17G31	◑⊖ 30, 55 10RW- 7	◑● 55, 90 10 3	◑● 8, 90 6F 4	◑ 5 4F 6	◑◑ 5, 90 4F 8	◑ 5 4F 6	⊕ 10V 7 9	⊕ 8 7 13	● 17 10 14	◑◑ 17, 250 10 13G21	◑ 25 15 13	◑ 25 15 11	◑● 25, 60 15 14	◑⊕ 40, 60 7TRW- 19	◑● 30, 80 10 12	◑◑ 30, 90 15 9	◑○ 50 15 13	◑◑ 50, 90 15 8	◑◑ 50, 90 15 5	◑ 40 15 7	◑ 90 15 9	◑ 90 15 9	◑ 90 15 9	EXPLANATION OF HOURLY REPORTED WEATHER DATA BLOCKS SEE LEGEND AS AN EXAMPLE
4-14-84	SAT	◑● 90, 250 15 9	◑● 90, 250 15 12	◑○ 75 15 4	◑◑ 45, 75 15 8	◑◑ 45, 85 15 10	◑⊕ 40, 250 15 7	◑⊕ 40, 55 8RW- 8	◑⊕ 40, 65 7RW- 10	◑⊕ 17, 70 7RW- 8	◑⊕ 20, 55 6TRW- 10	◑⊕ 20, 100 6H 8	◑● 80, 250 8 8	◑◑ 30, 250 15 5	◑ 35 15 10	◑◑ 38, 250 15 7	◑ 45 15 6	●⊕ 38, 70 15TRW- 18G25	◑⊕ 20, 80 10TRW- 3	◑⊕ 45, 80 8RW- 8	◑ 50 15 7	● 90 15 4	◑ 90 15 3	⊕ 90 15 5	◑⊖ 40, 90 15 10	
4-15-84	SUN	⊖ 65 10 8	⊖ 41 10 0	◑ 40 10 4	◑ 45 7 4	◑◑ 30, 60 7 7	○ 5F 7	◑ 40 5F 6	◑⊕ 50, 65 5FH 8	⊕ 65 5H 6	◑⊕ 30, 75 6H 10	◑⊕ 20, 80 6H 14	◑⊕ 30, 65 7 10	●◑ 30, 70 10 16	◑⊕ 30, 70 10 12	◑◑ 30, 70 12 12	◑● 35, 80 12 14	◑● 40, 90 15 14	◑◑ 40, 90 15 14	◑⊕ 80, 120 15 10	◑⊕ 65, 100 15 8	◑⊕ 50, 90 15 8	◑ 90 15 4	● 75 15 5	◑⊕ 35, 65 15 5	

LEGEND:

○	– SKY CONDITION (○ = CLEAR ◑ = SCATTERED ⊕ = BROKEN ● = OVERCAST ⊗ = X OBSCURED; -X PARTIALLY OBSCURED)
250	– CEILING HEIGHT (HEIGHT OF CLOUD LAYERS EXPRESSED IN HUNDREDS OF FEET AGL)
15	– VISIBILITY (EXPRESSED IN STATUTE MILES)
14G26	– WIND SPEED (EXPRESSED IN KNOTS, "G" INDICATES GUSTY)

SURFACE WEATHER OBSERVATIONS

CRITERIA FOR GENERATING THE WEATHER INDEX

	DETERMINATE CRITERIA		SCORE	
SKY CONDITIONS	• CLEAR	< 1/10	• ○ 0	>CLEAR
	• PARTLY CLOUDY	1/10 - 9/10	• ◐ .3	>PARTLY CLOUDY
	• CLOUDY	10/10	• ◍ -X .7 • ⊕ X 1.0	>CLOUDY
VISIBILITY	• GOOD	≥ 7 MILES	• ≥ 7	0 > GOOD
	• MARGINAL	3 - 6 MILES	• 3-6 (Low Clouds) • 3-6 (High Clouds)	.3 > MARGINAL
	• POOR	≤ 3 MILES	• <3	.7 > POOR 1.0
WIND SPEED	• CALM	0 KNOTS	• 0	> LIGHT
	• LIGHT	1-5 KNOTS	• .3	> MODERATE
	• MODERATE	6-9 KNOTS	• .7	> STRONG
	• STRONG	≥ 10 KNOTS	• 1.0	

NOTE[11]: These scores have been used only for numeric representation of weather and for comparison under Pre and Post ARSA periods (this scale not to be used for weather forecasting)

11. Glossary of Meteorology edited by Ralph E. Huschke; American Meteorological Society, Boston, Mass.

WEATHER DIFFERENCE PROFILE OF SELECTED 7 DAYS

IN PRE AND POST ARSA PERIODS

ROBERT MUELLER MUNICIPAL AIRPORT - AUSTIN, TEXAS

PRE-ARSA DATE	POST-ARSA DATE	DAY	SKY COVER	VISI-BILITY	WIND SPEED
11-21-83	3-19-84	Monday	-.13	+.02	+.14
11-22-83	3-27-84	Tuesday	-.14	+.31	+.05
11-16-83	3-07-84	Wednesday	-.01	0	+.05
11-17-83	3-01-84	Thursday	+.09	0	+.06
11-18-83	3-16-84	Friday	+.01	+.20	+.20
11-19-83	3-10-84	Saturday	+.35	0	-.29
11-20-83	3-25-84	Sunday	+.60	0	-.08
Average over the week.			+.11	+.07	-.04

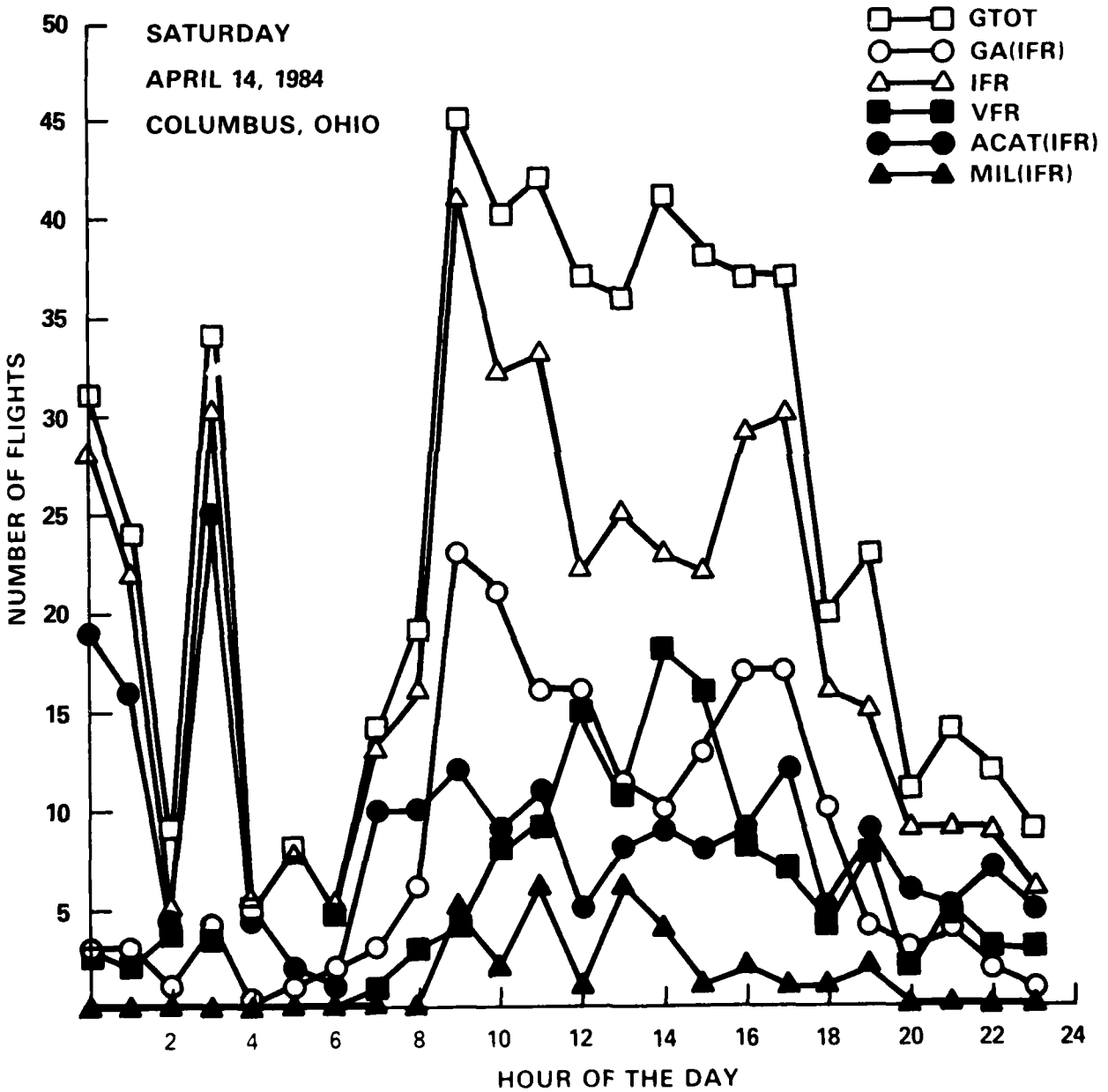
PORT COLUMBUS INTERNATIONAL AIRPORT - COLUMBUS, OHIO

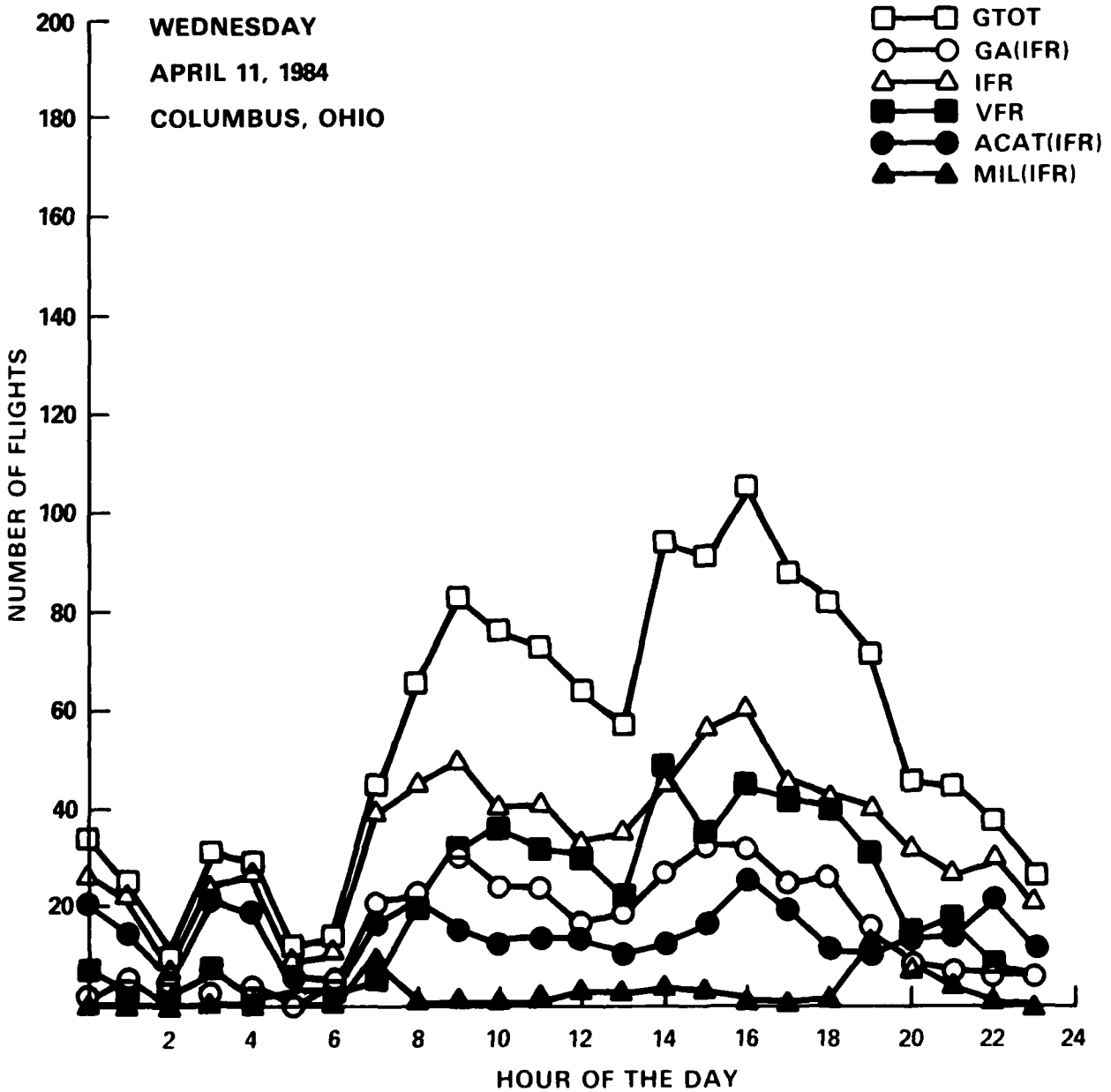
PRE-ARSA DATE	POST-ARSA DATE	DAY	SKY COVER	VISI-BILITY	WIND SPEED
11-14-83	4-02-84	Monday	+.07	+.02	-.10
11-08-83	4-10-84	Tuesday	+.14	0	+.67
11-09-83	4-11-84	Wednesday	-.28	0	+.07
11-10-83	3-22-84	Thursday	+.13	-.02	+.39
11-11-83	3-16-84	Friday	-.01	-.25	+.03
11-12-83	4-14-84	Saturday	+.05	+.04	-.07
11-13-83	4-08-84	Sunday	-.19	0	+.40
Average over the week.			-.01	-.03	+.20

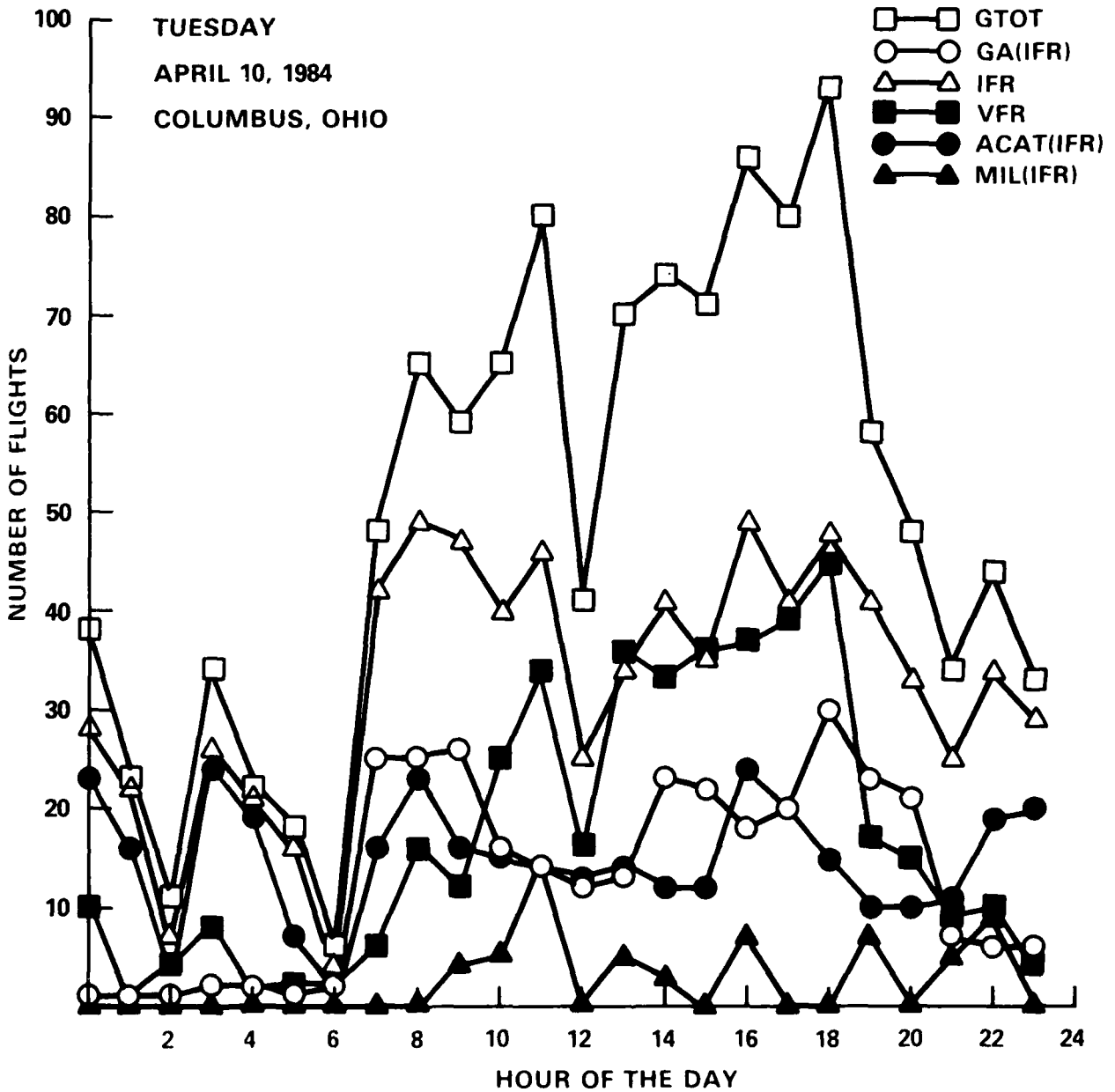
APPENDIX J

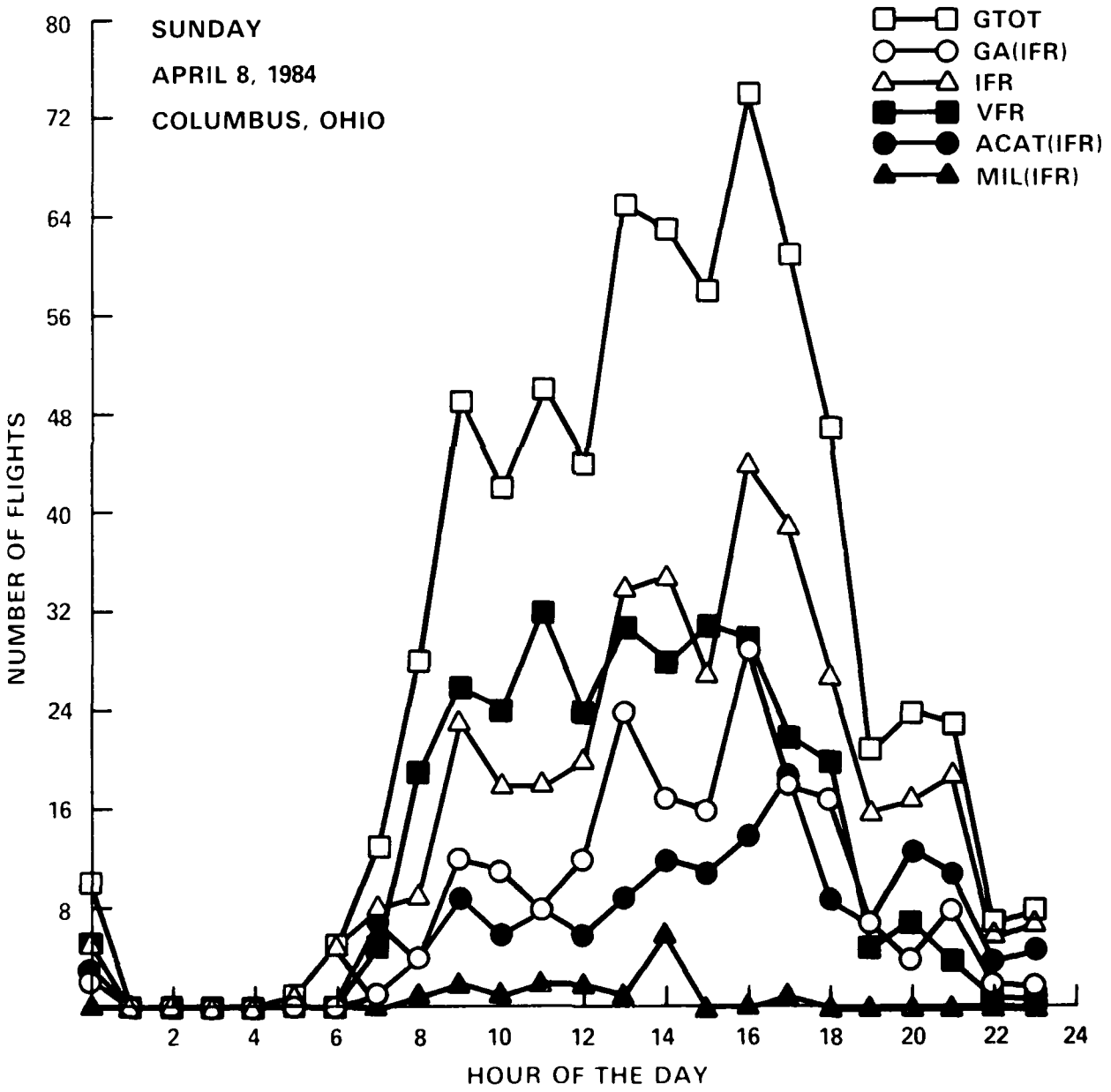
HOURLY TRACON TRAFFIC COUNTS DISTRIBUTION FOR

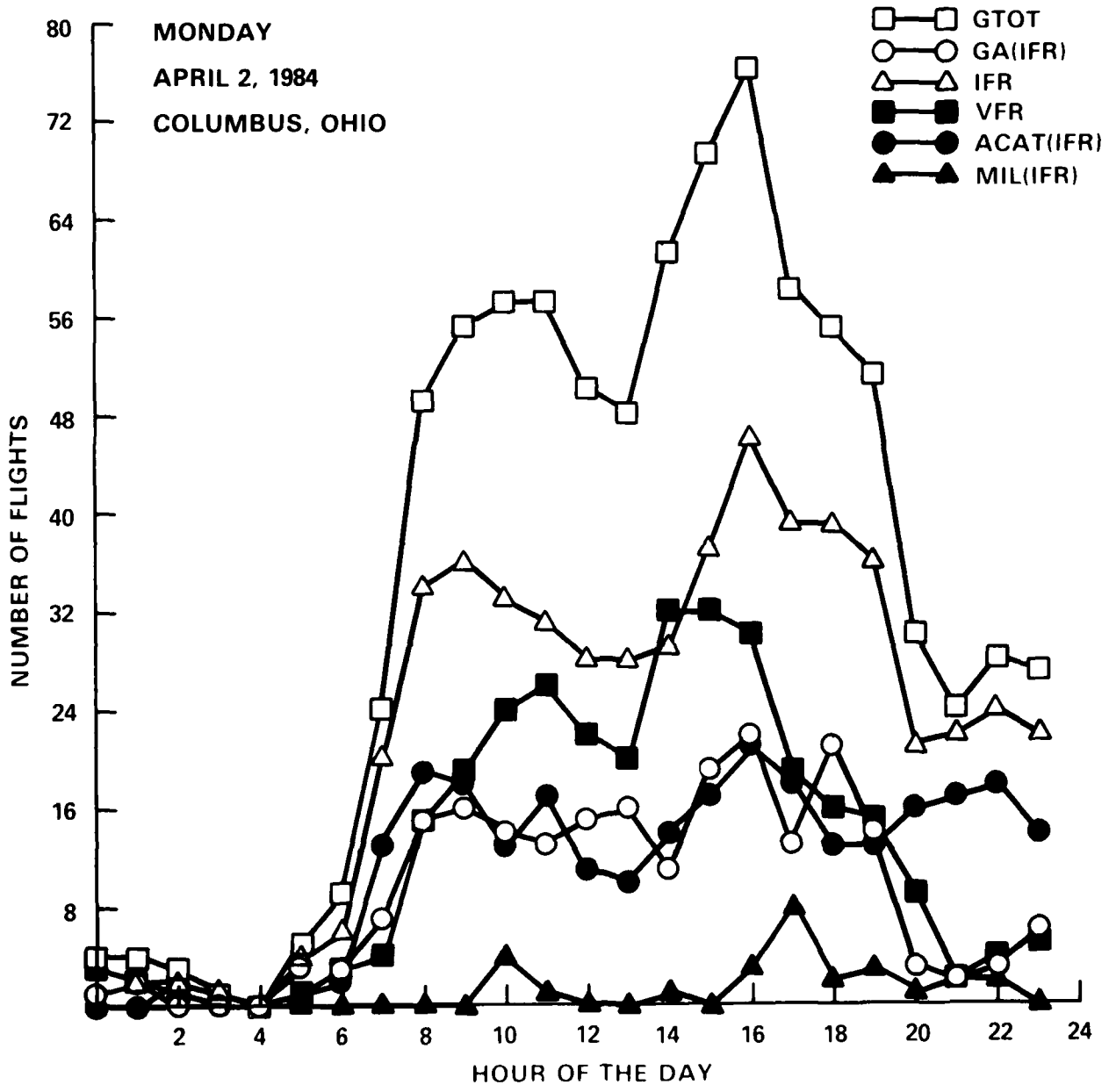
PRE AND POST ARSA PERIODS AT AUSTIN AND COLUMBUS SITES

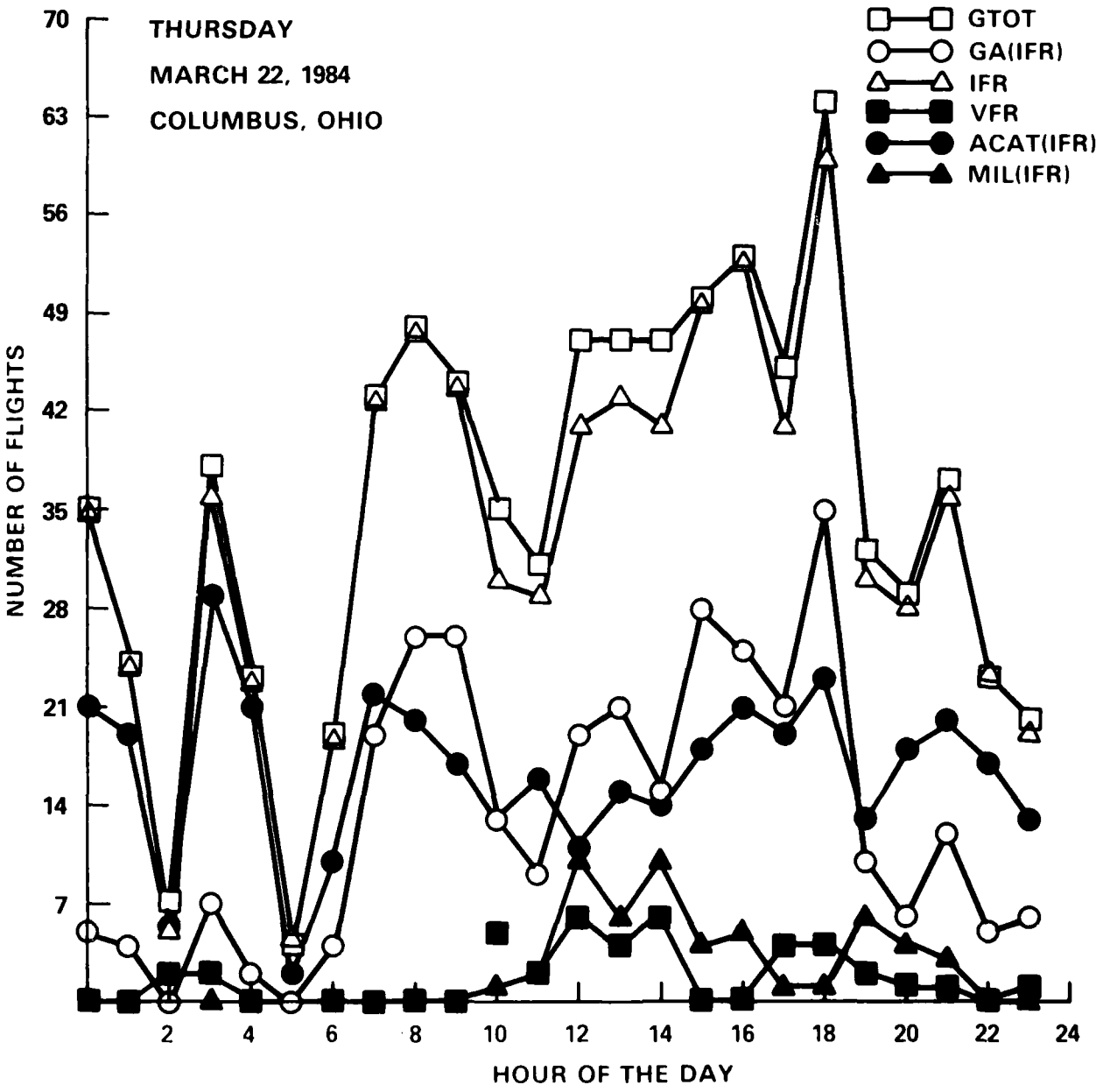

SATURDAY
APRIL 14, 1984
COLUMBUS, OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
50
45
40
35
30
25
20
15
10
5
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

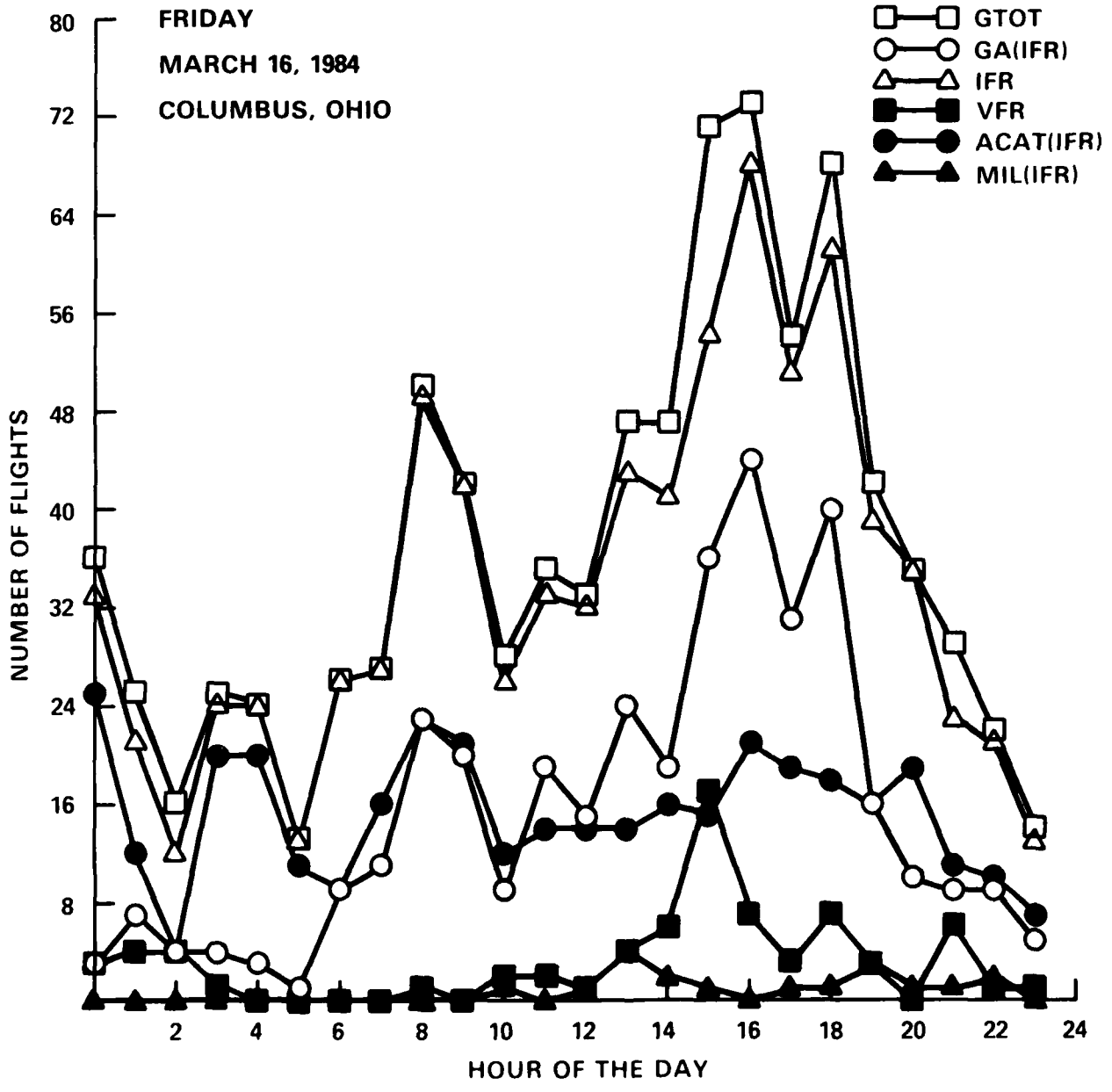

WEDNESDAY
APRIL 11, 1984
COLUMBUS, OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
200
180
160
140
120
100
80
60
40
20
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

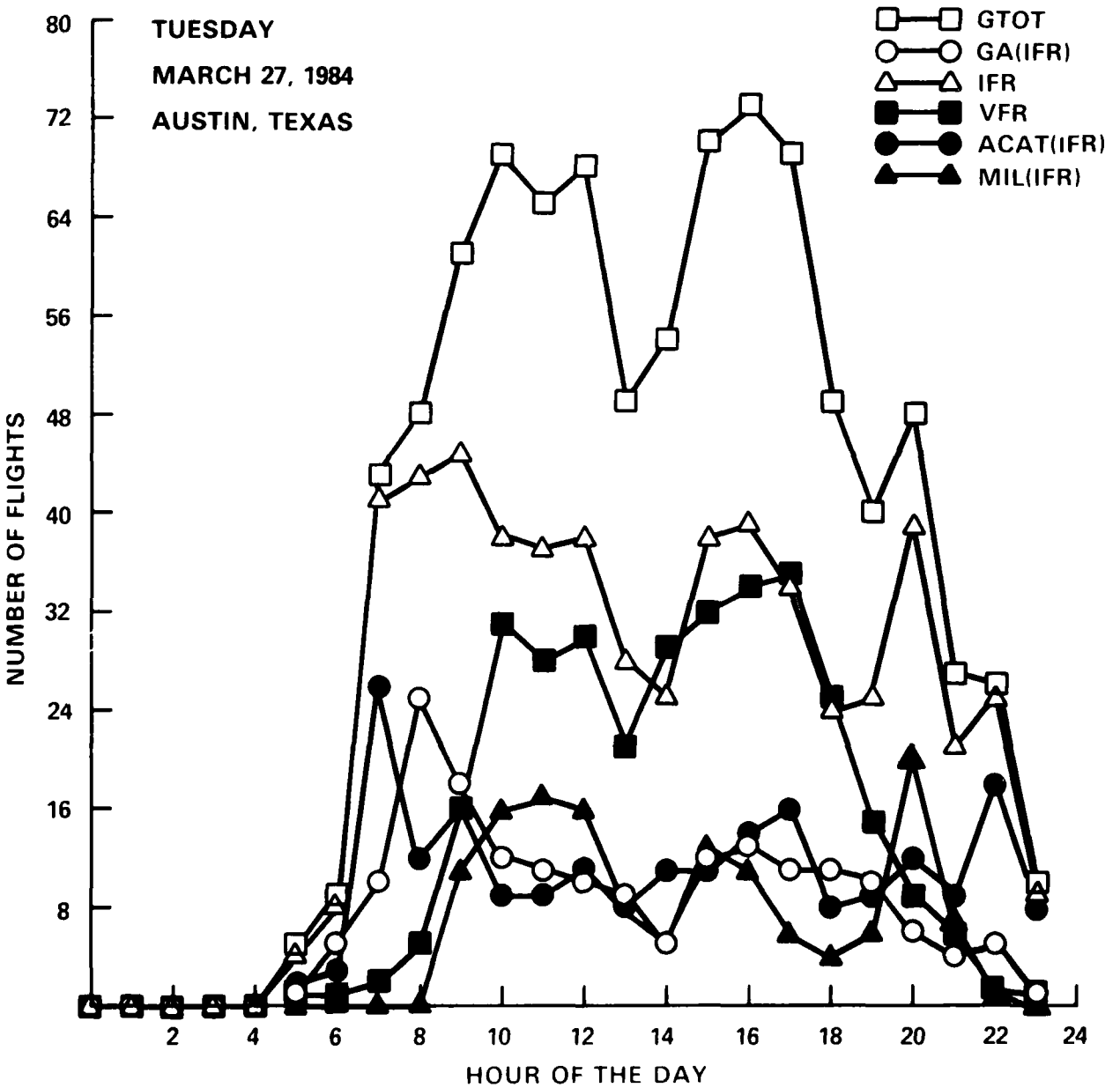

TUESDAY
APRIL 10, 1984
COLUMBUS, OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
100
90
80
70
60
50
40
30
20
10
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

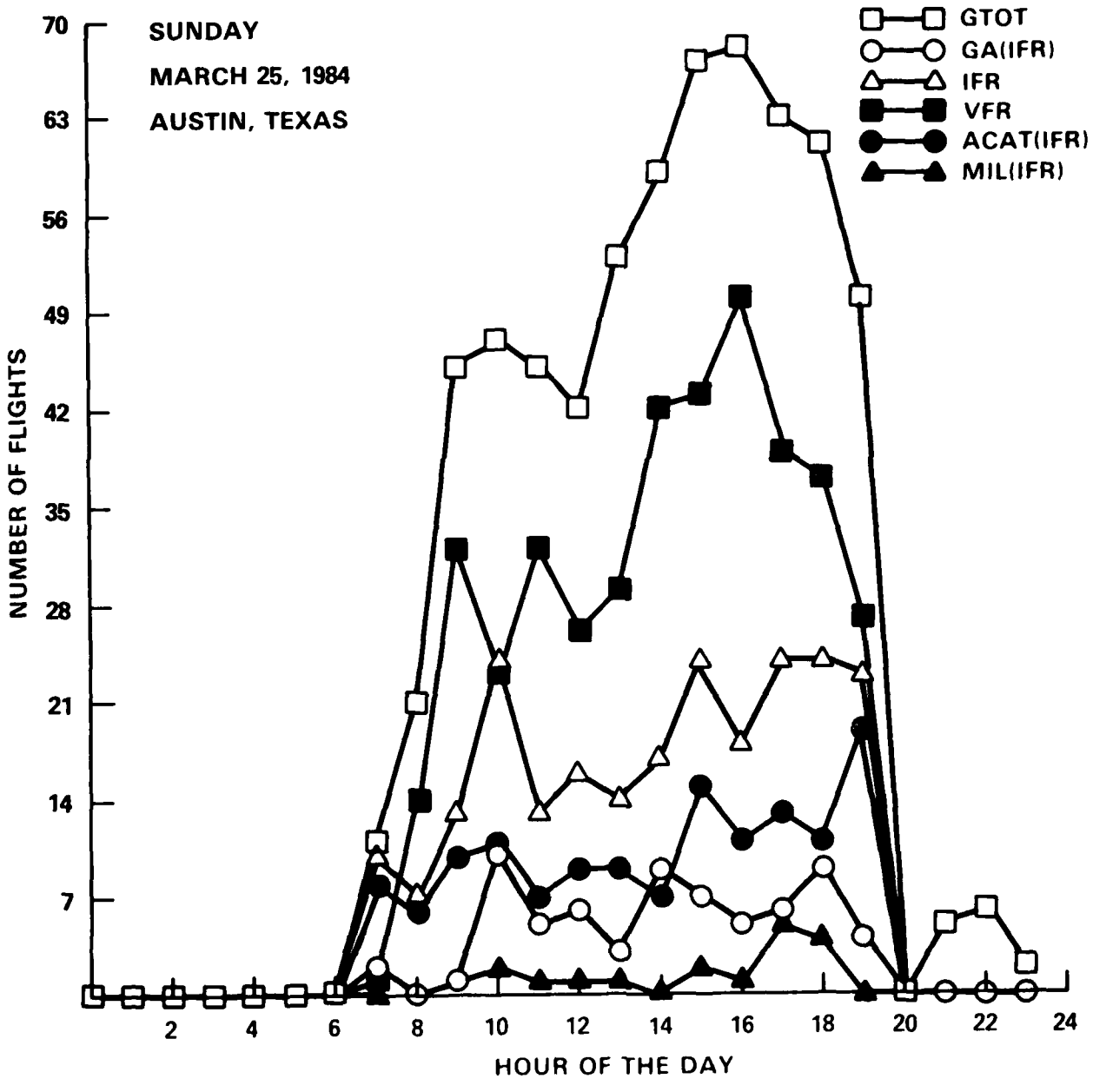

SUNDAY
APRIL 8, 1984
COLUMBUS, OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
80
72
64
56
48
40
32
24
16
8
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

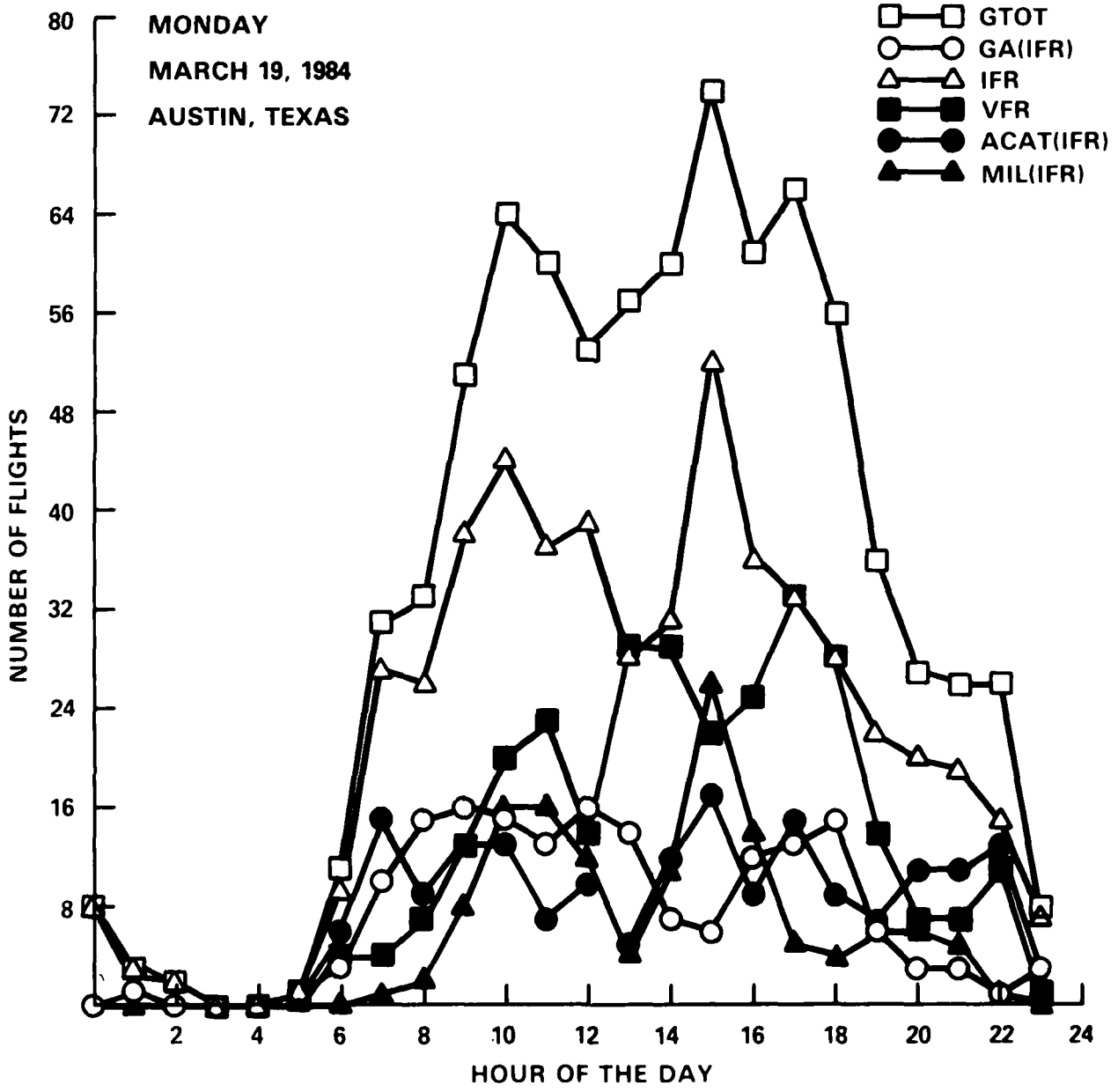

MONDAY
APRIL 2, 1984
COLUMBUS, OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
80
72
64
56
48
40
32
24
16
8
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

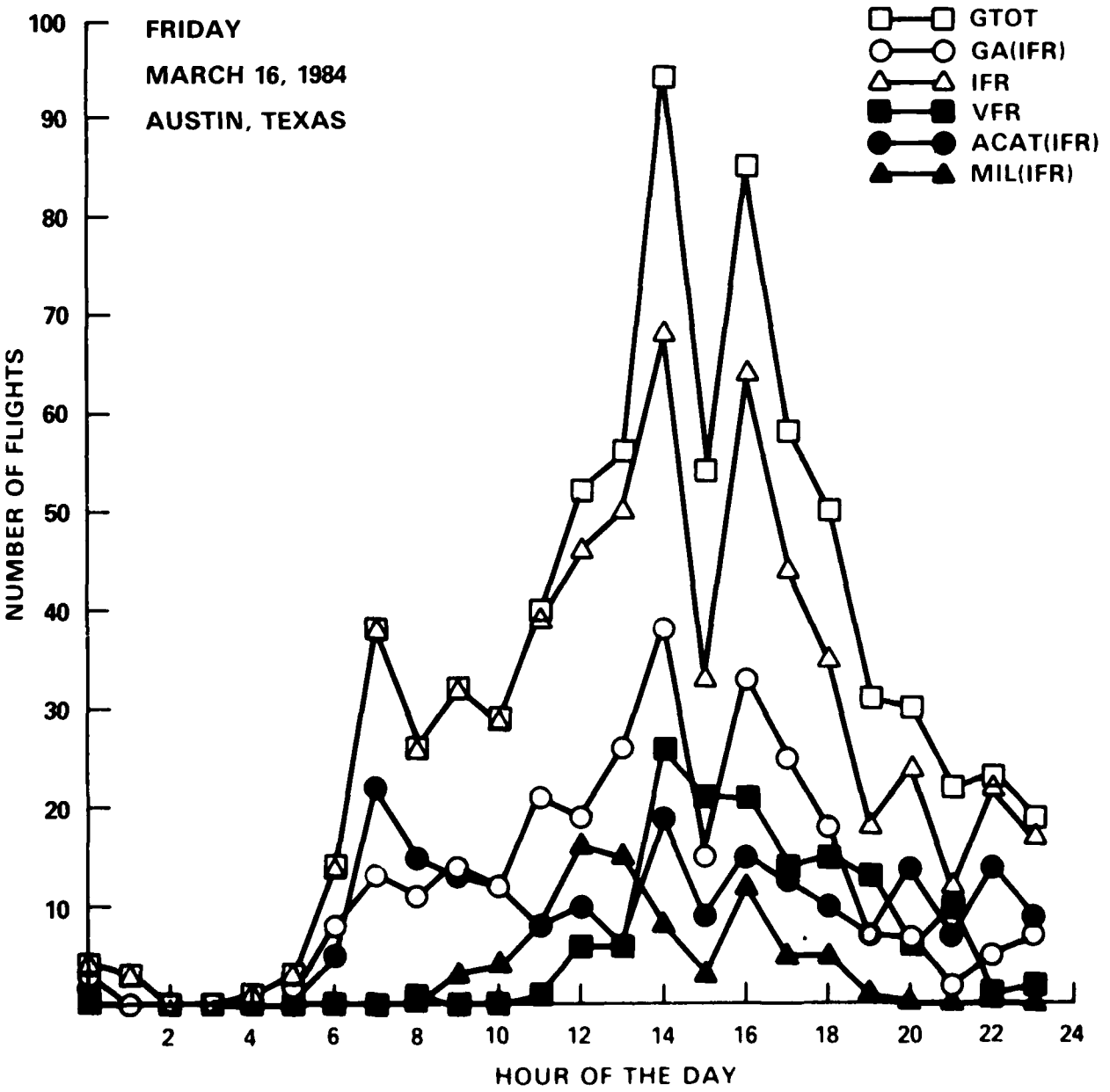

THURSDAY
MARCH 22, 1984
COLUMBUS, OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
70
63
56
49
42
35
28
21
14
7
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

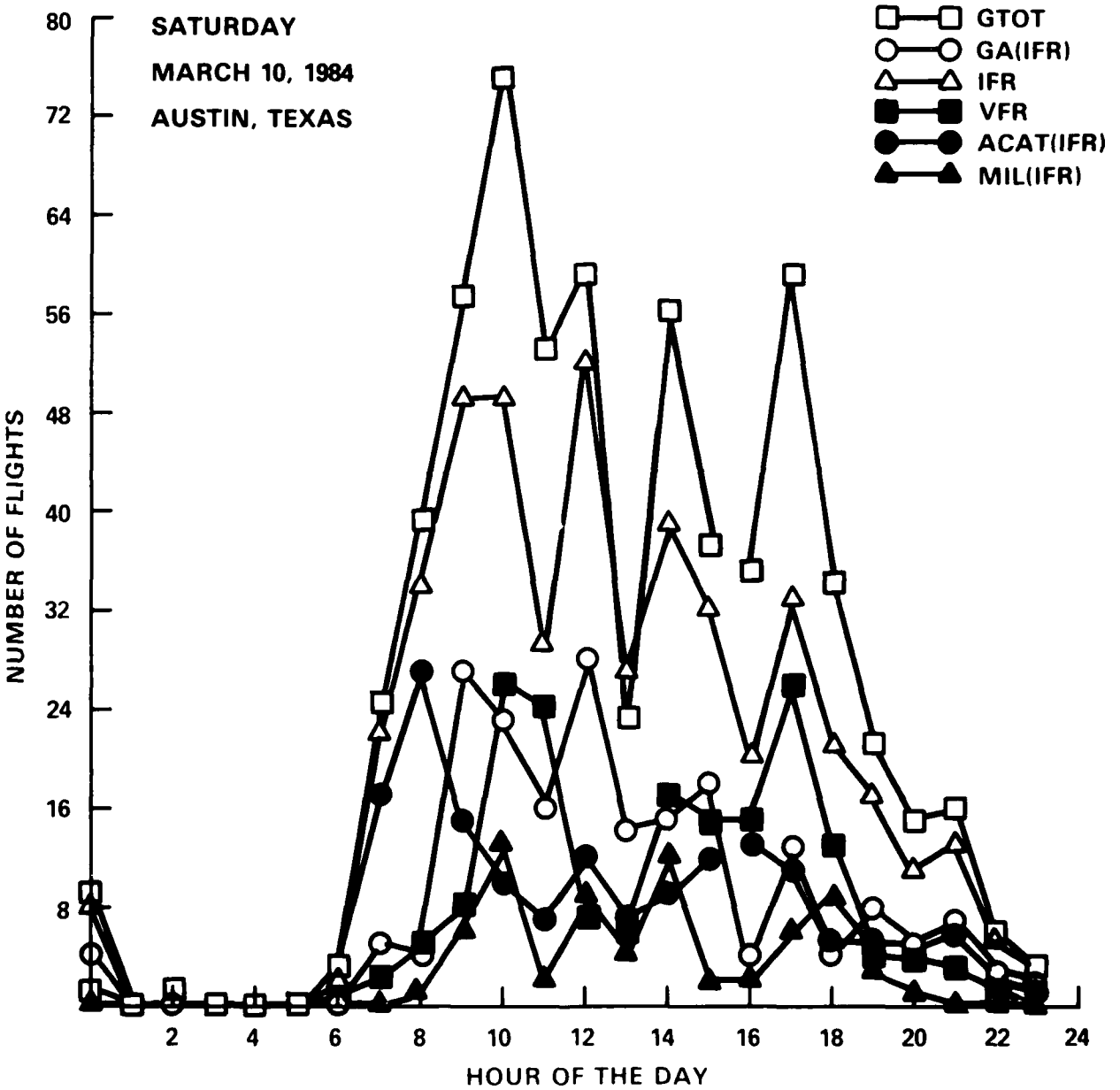

FRIDAY
MARCH 16, 1984
COLUMBUS, OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
80
72
64
56
48
40
32
24
16
8
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

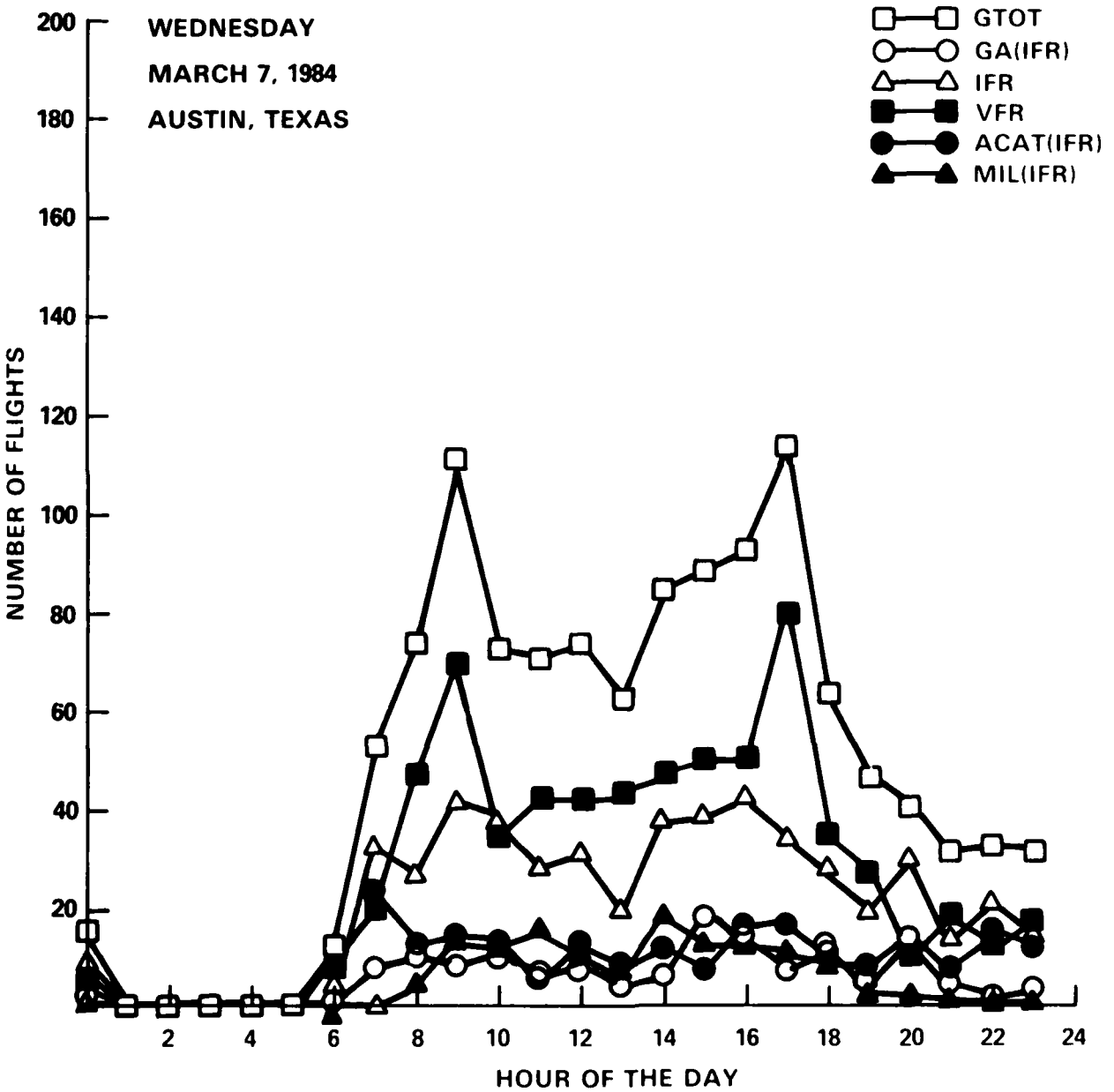

TUESDAY
MARCH 27, 1984
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
80
72
64
56
48
40
32
24
16
8
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

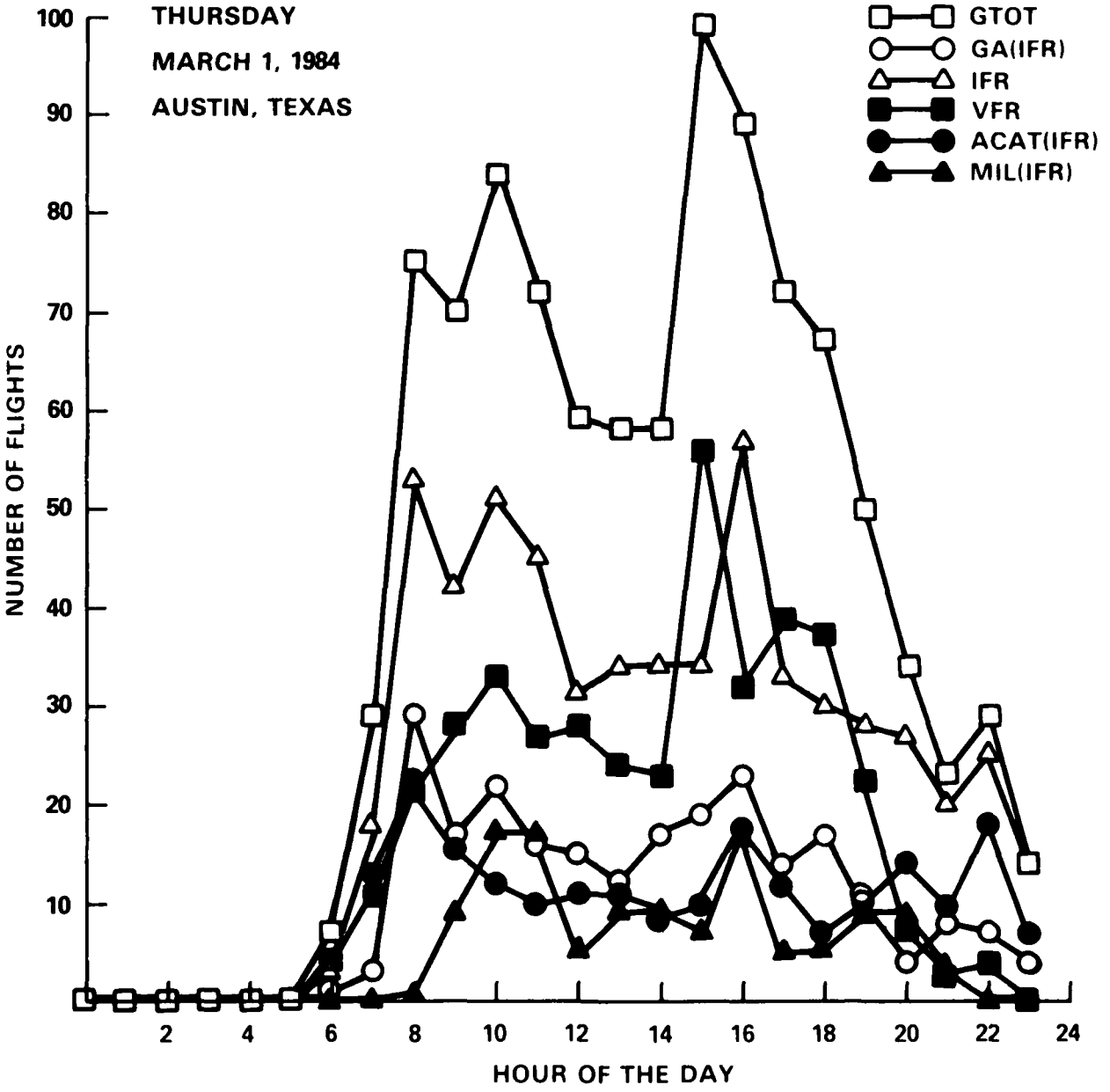

SUNDAY
MARCH 25, 1984
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
70
63
56
49
42
35
28
21
14
7
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

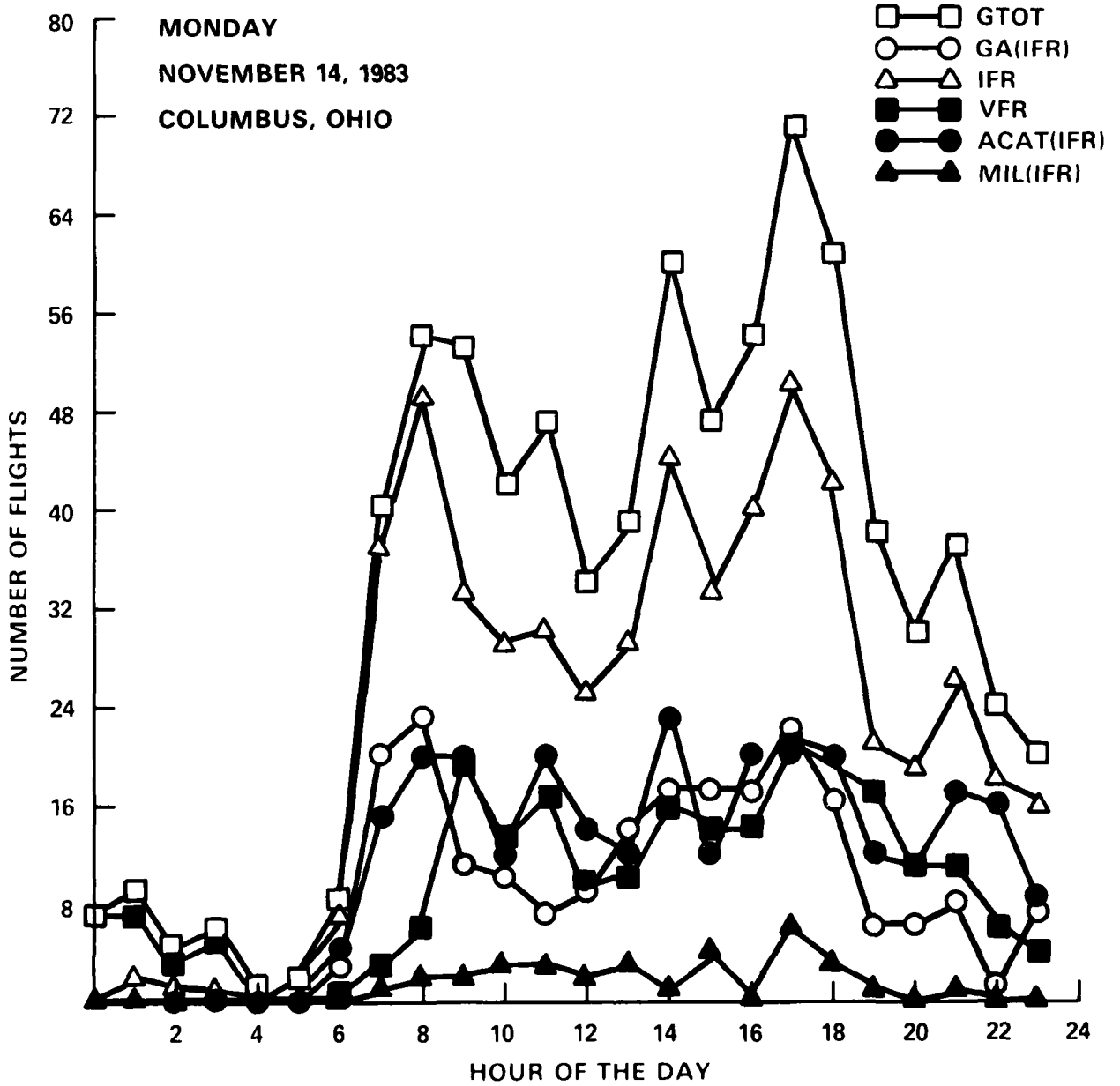

MONDAY
MARCH 19, 1984
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
80
72
64
56
48
40
32
24
16
8
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

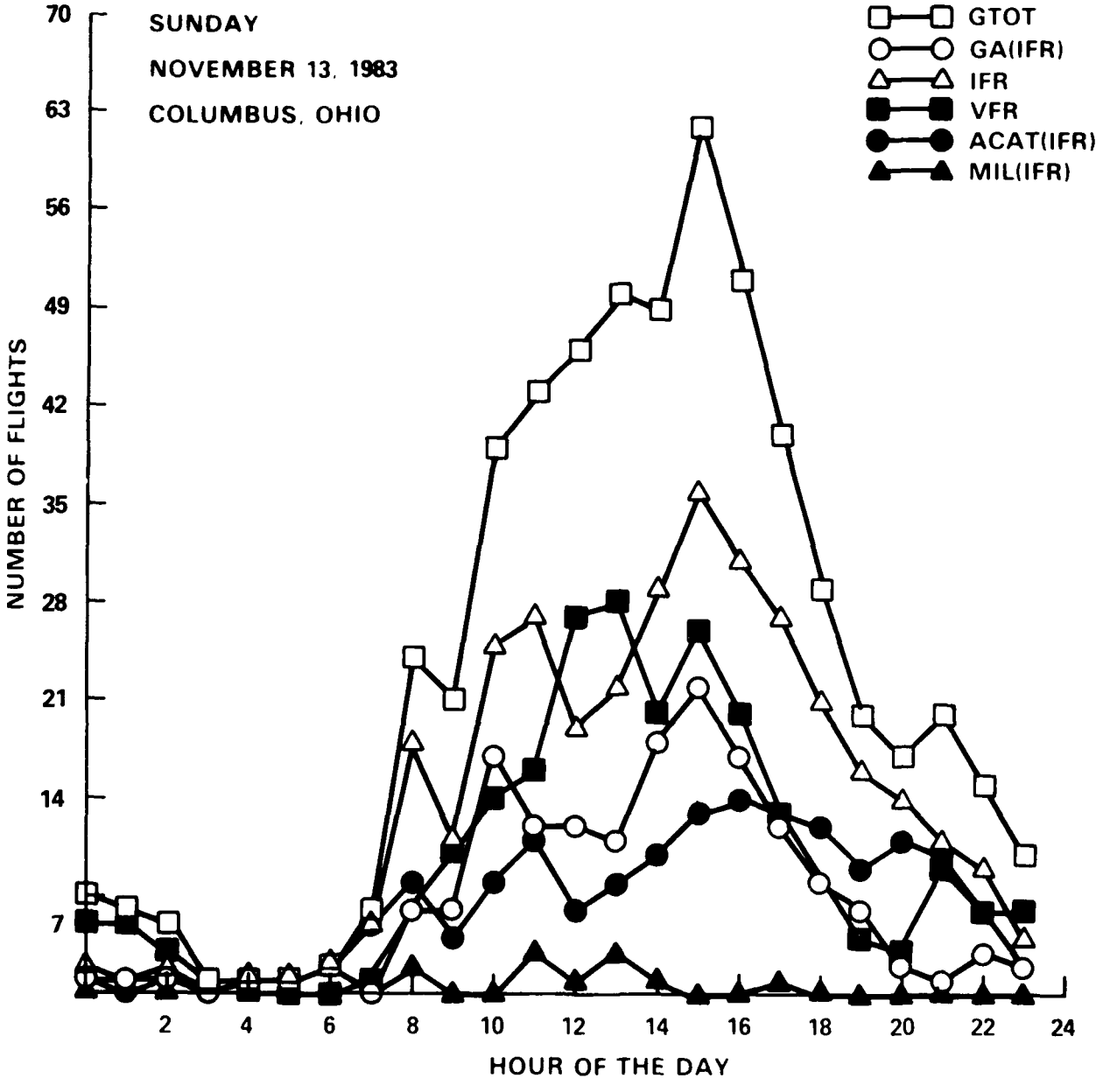

FRIDAY
MARCH 16, 1984
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
100
90
80
70
60
50
40
30
20
10
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

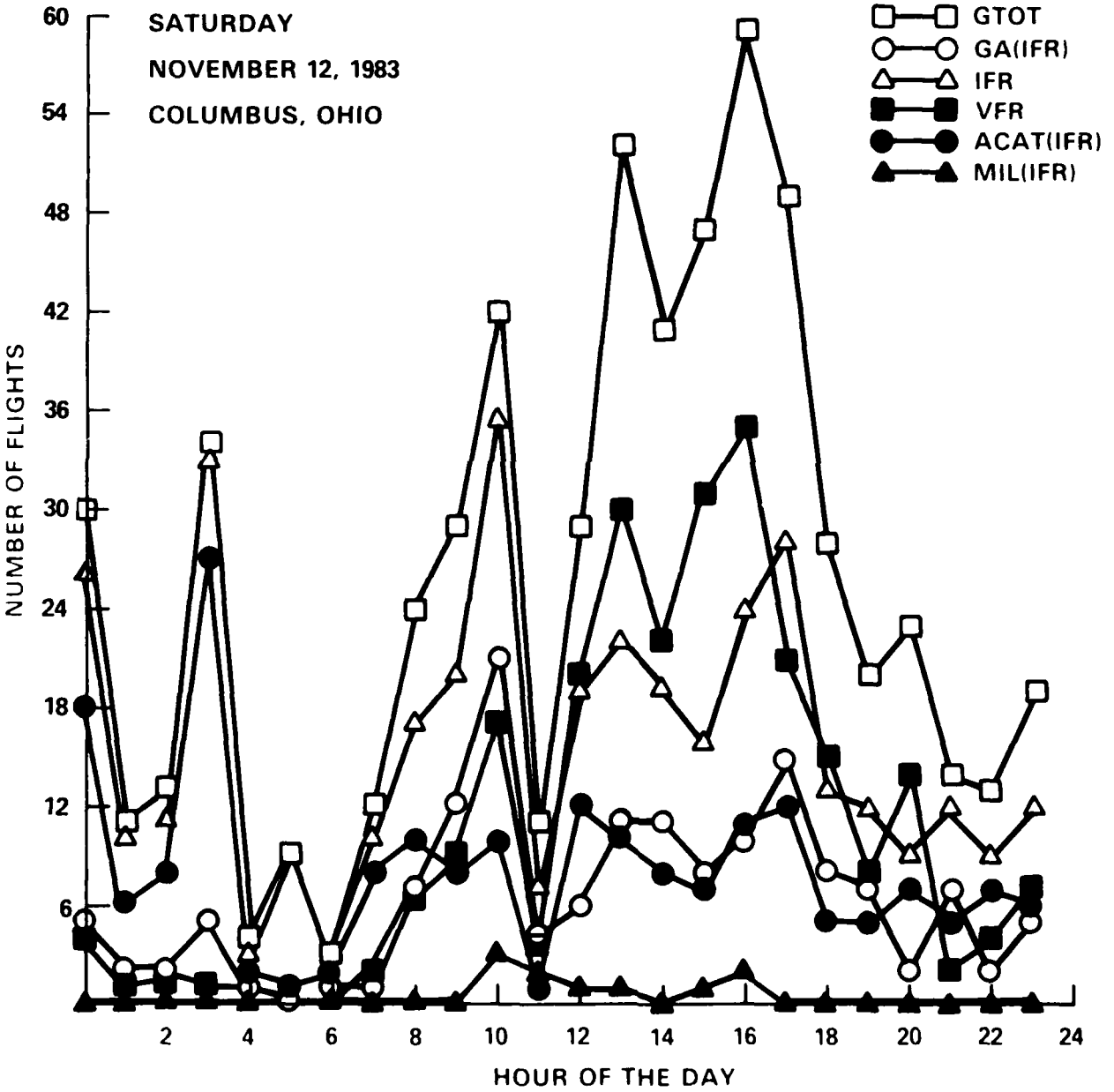

SATURDAY
MARCH 10, 1984
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
80
72
64
56
48
40
32
24
16
8
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

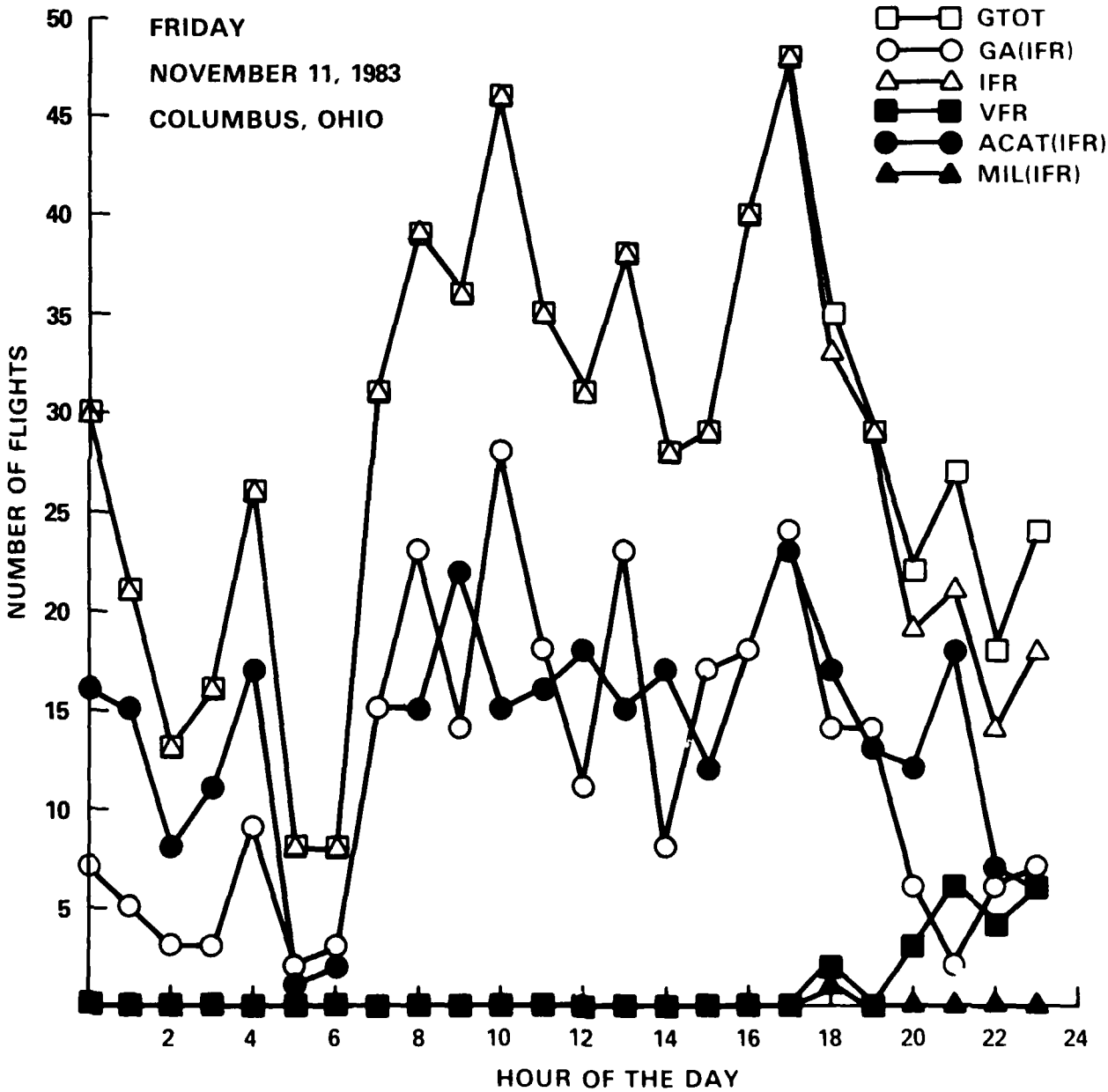

WEDNESDAY
MARCH 7, 1984
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
200
180
160
140
120
100
80
60
40
20
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

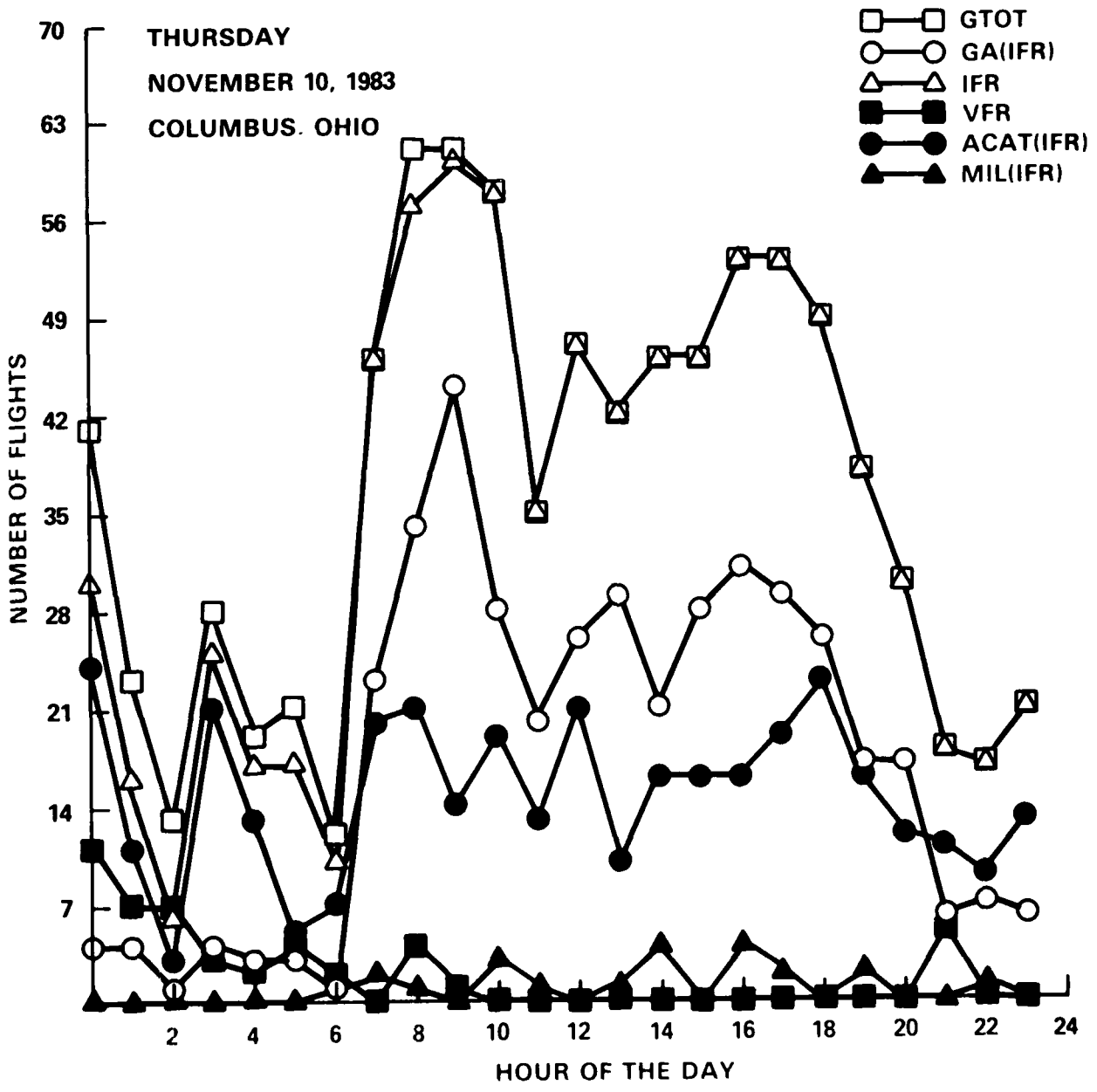

THURSDAY
MARCH 1, 1984
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
100
90
80
70
60
50
40
30
20
10
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

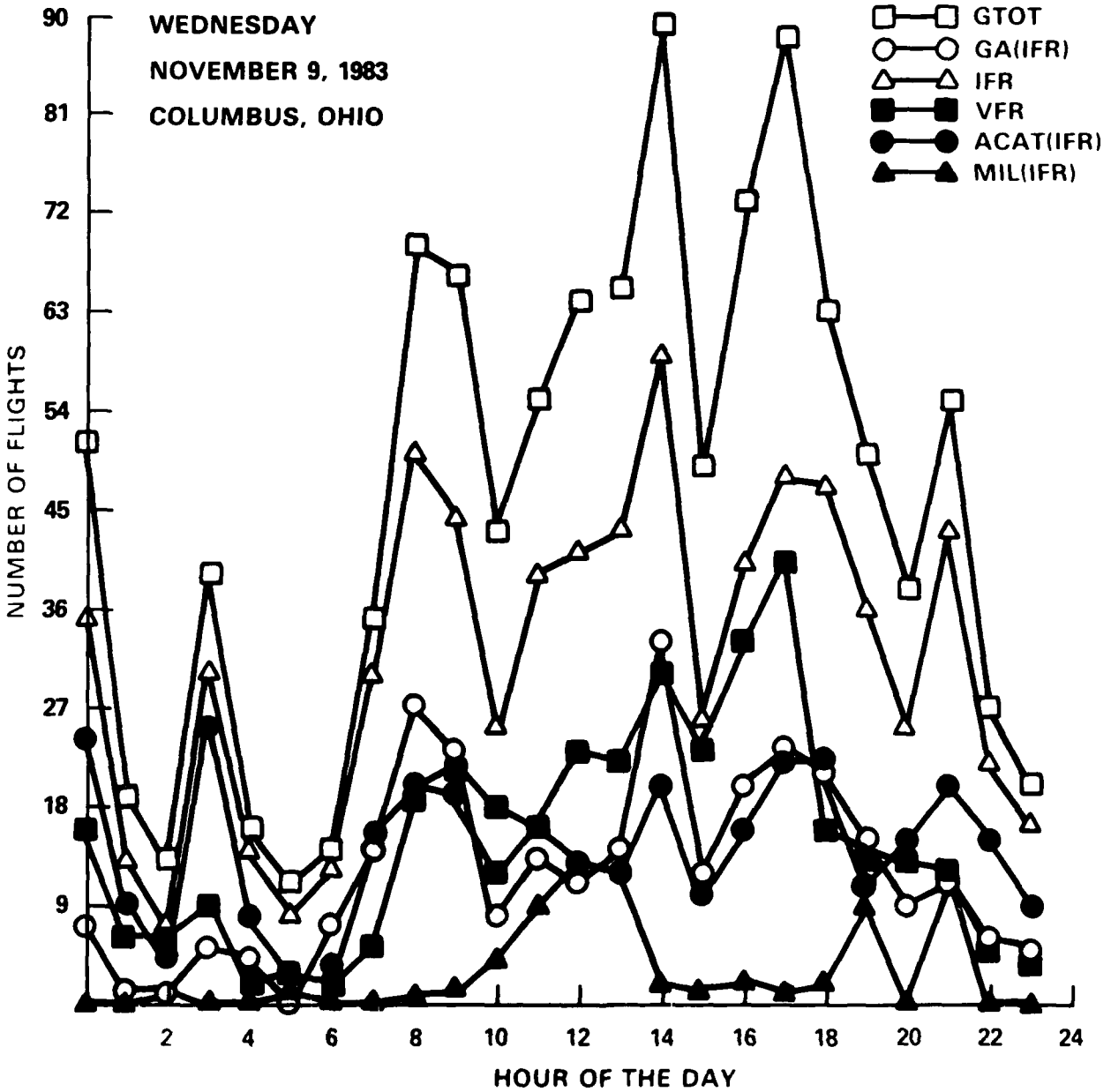

MONDAY
NOVEMBER 14, 1983
COLUMBUS, OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
80
72
64
56
48
40
32
24
16
8
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

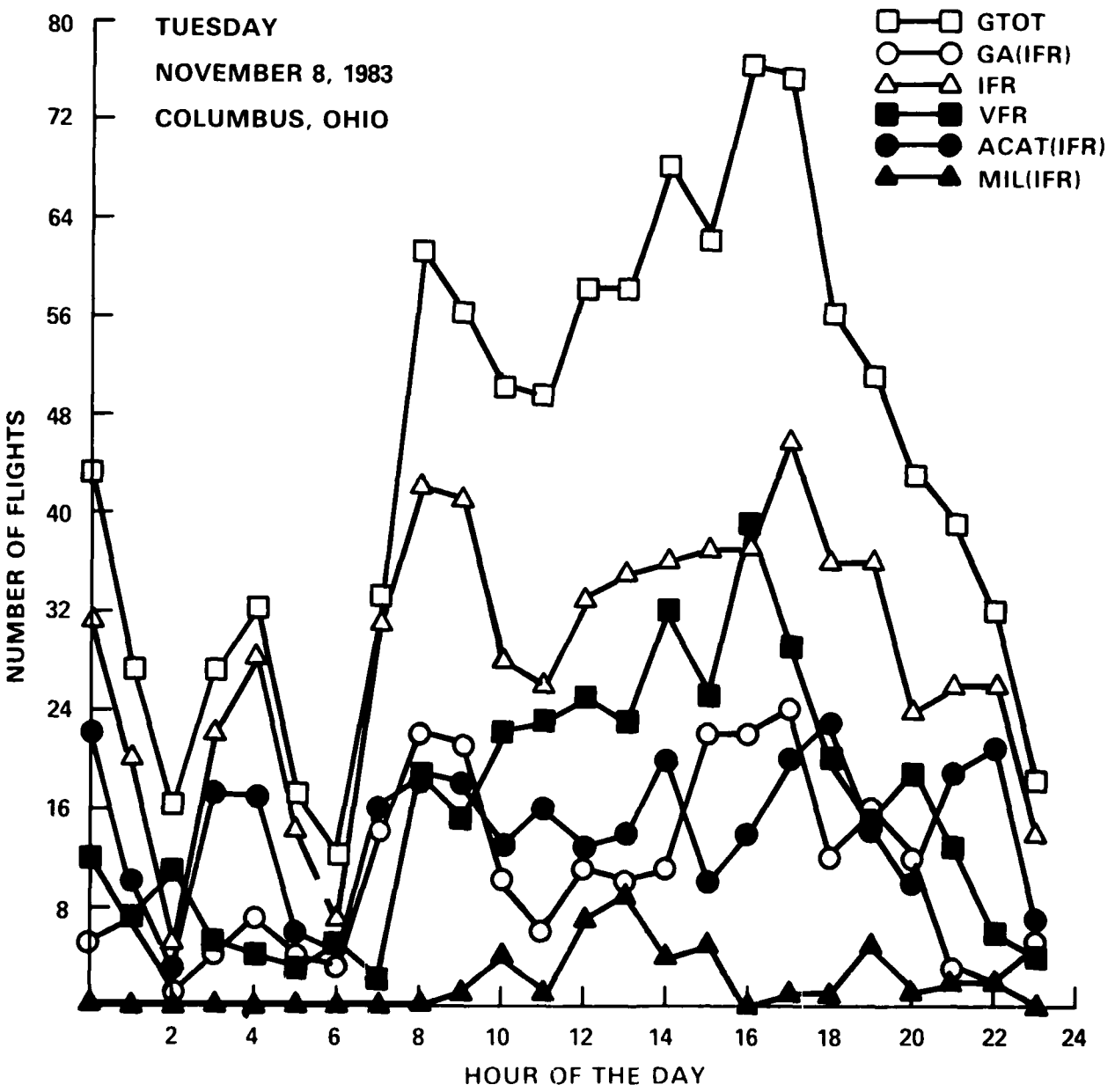

SUNDAY
NOVEMBER 13, 1983
COLUMBUS, OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
70
63
56
49
42
35
28
21
14
7
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

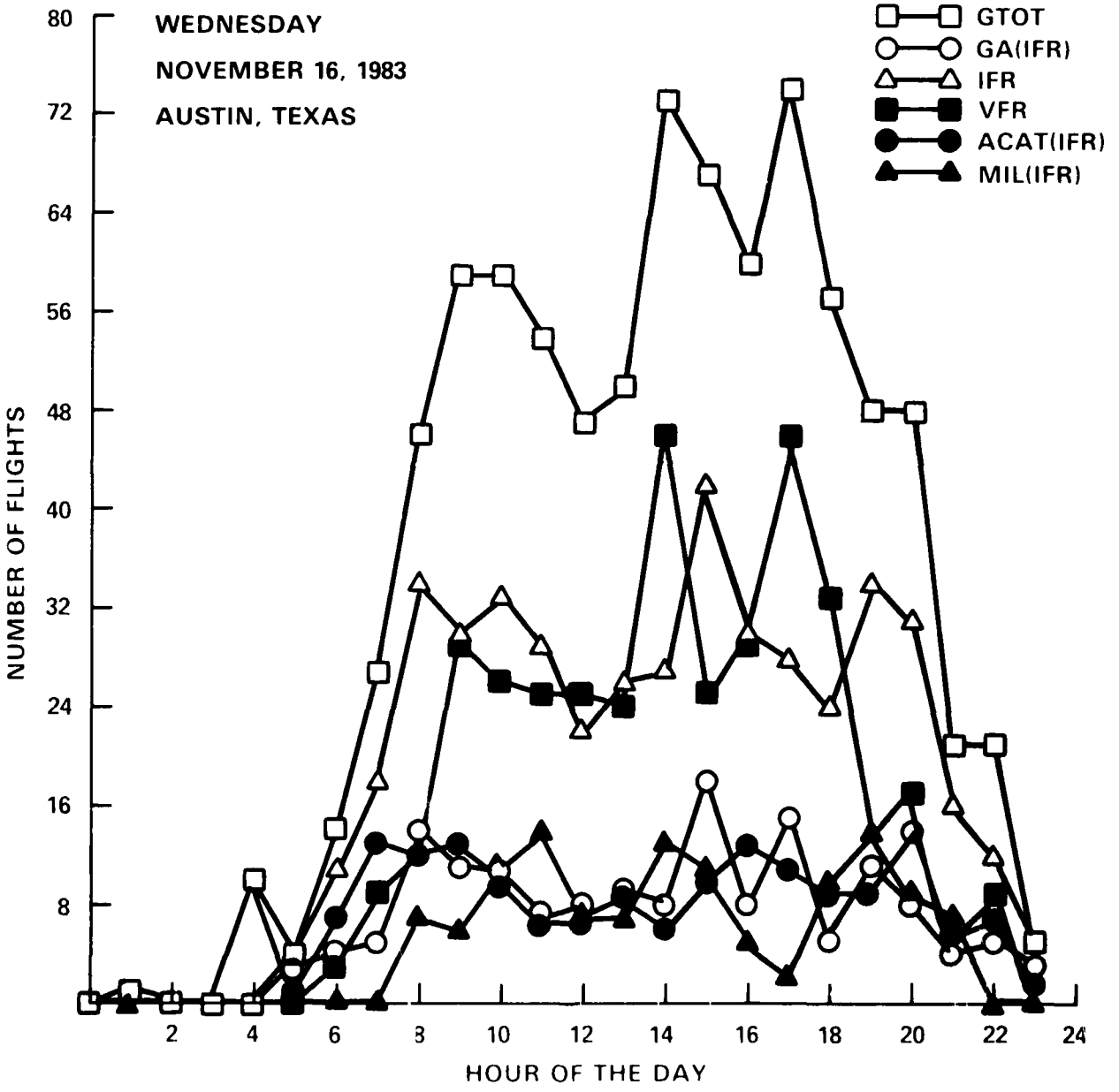

SATURDAY
NOVEMBER 12, 1983
COLUMBUS, OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
60
54
48
42
36
30
24
18
12
6
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

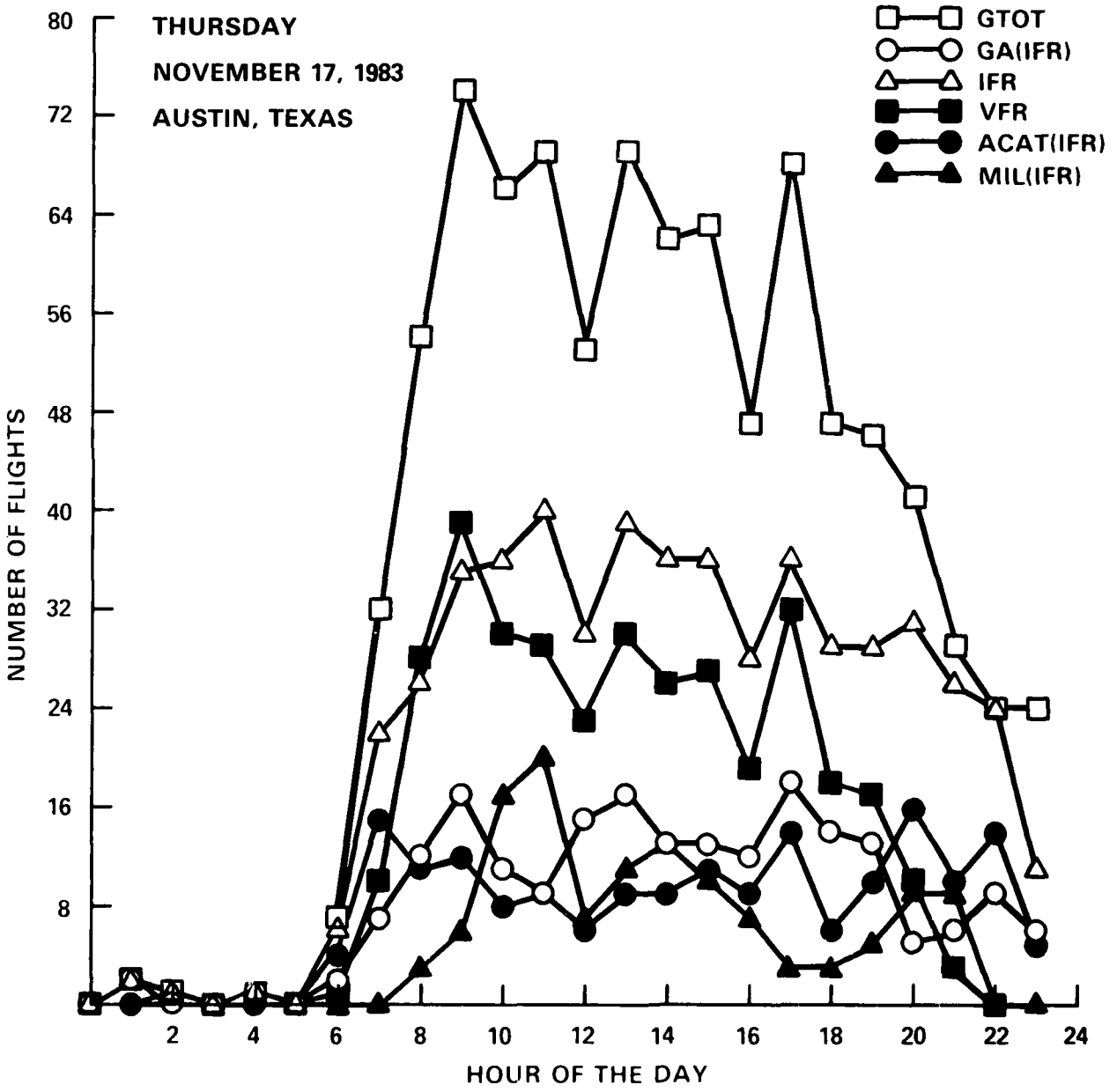

FRIDAY
NOVEMBER 11, 1983
COLUMBUS, OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
50
45
40
35
30
25
20
15
10
5
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

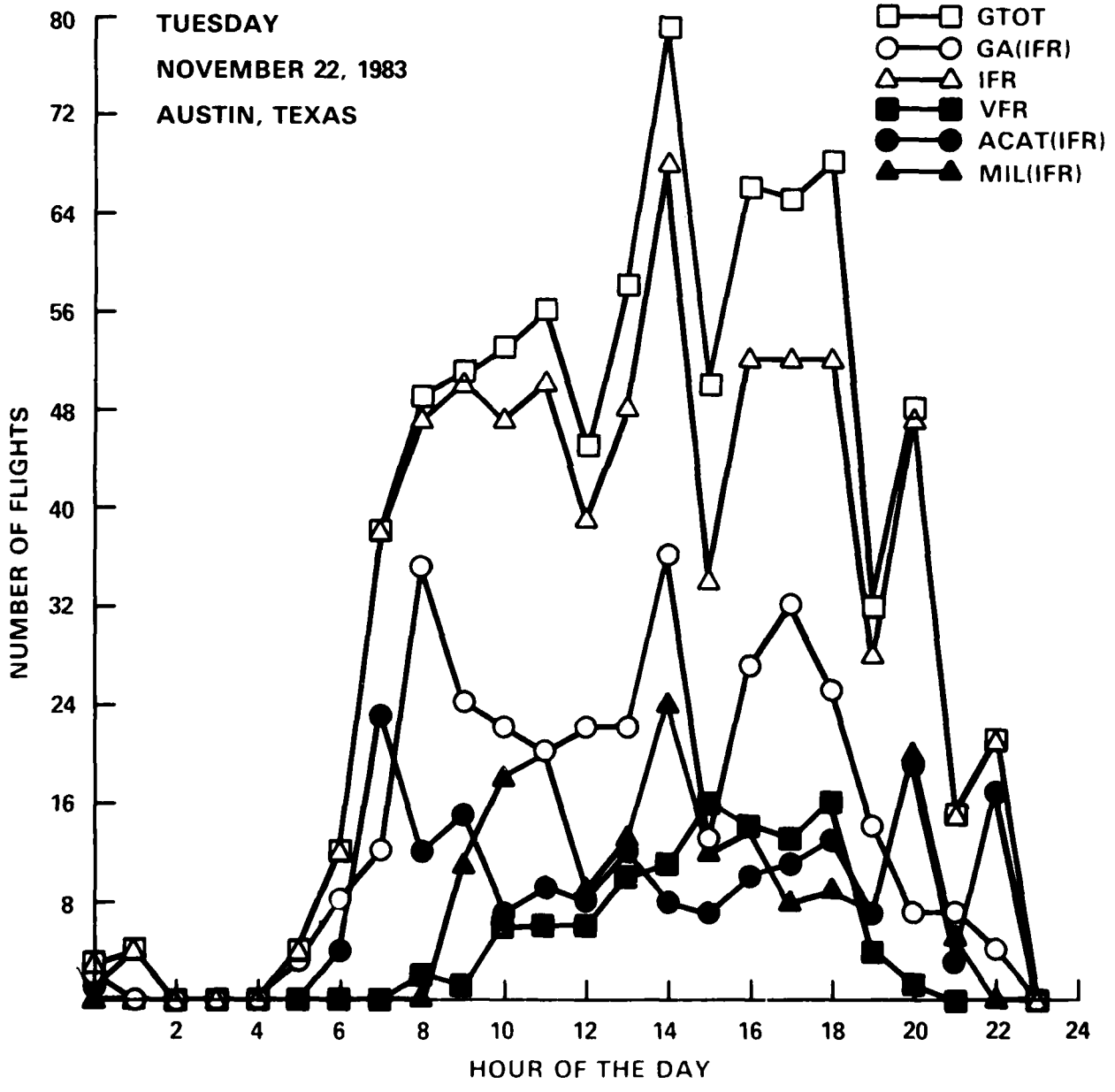

THURSDAY
NOVEMBER 10, 1983
COLUMBUS. OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
70
63
56
49
42
35
28
21
14
7
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

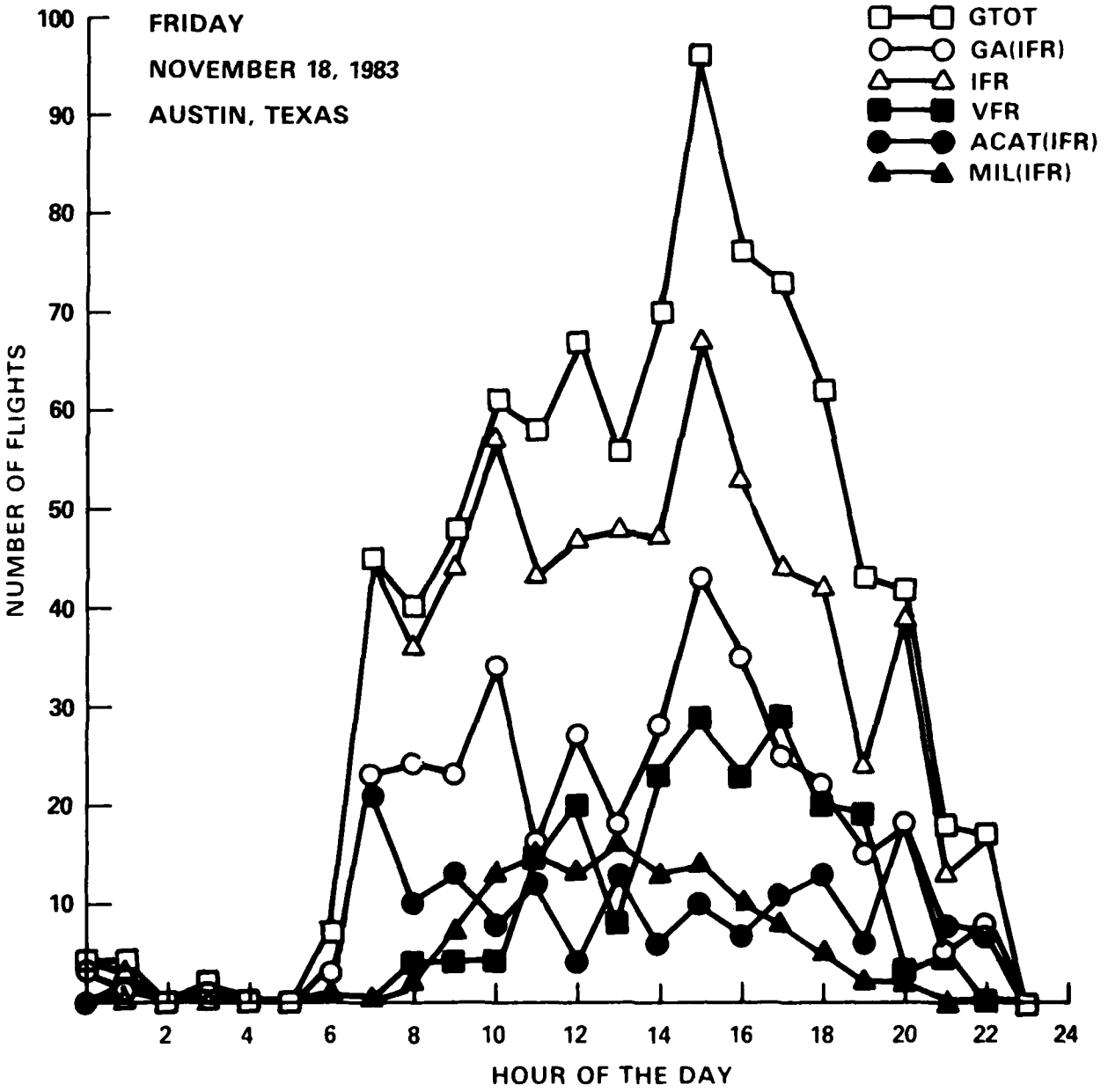

WEDNESDAY
NOVEMBER 9, 1983
COLUMBUS, OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
90
81
72
63
54
45
36
27
18
9
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

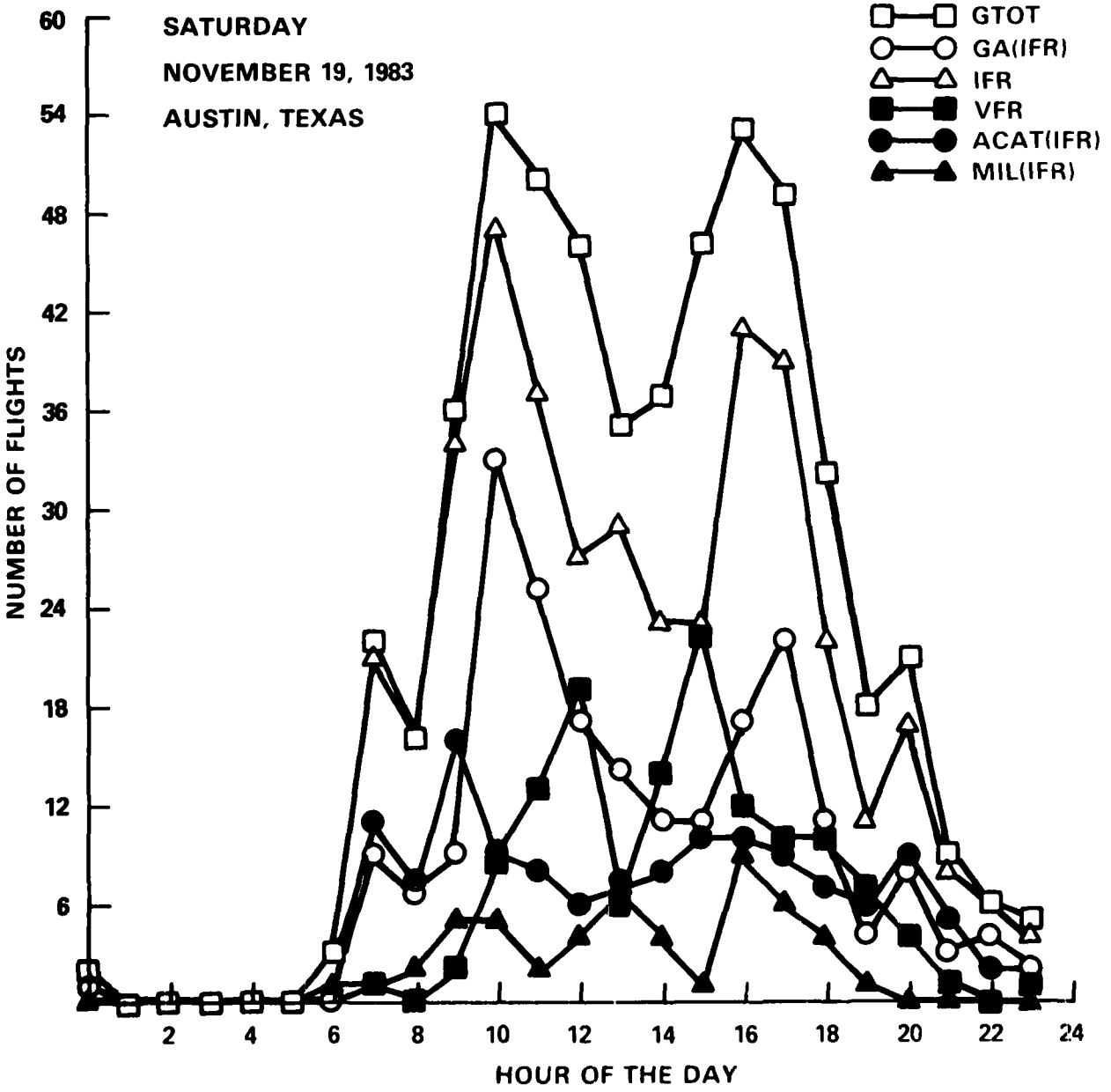

TUESDAY
NOVEMBER 8, 1983
COLUMBUS, OHIO
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
80
72
64
56
48
40
32
24
16
8
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

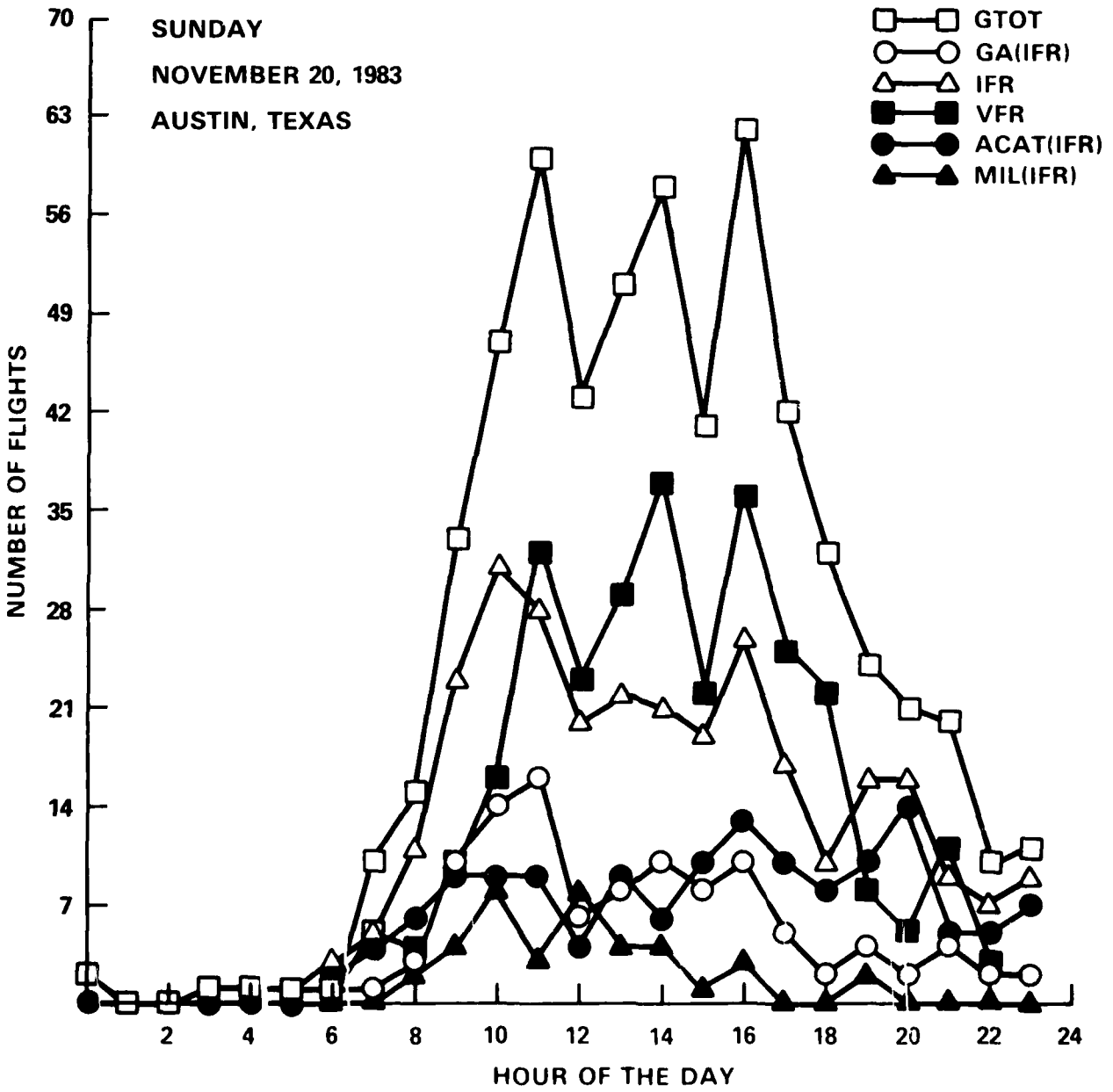

WEDNESDAY
NOVEMBER 16, 1983
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
80
72
64
56
48
40
32
24
16
8
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

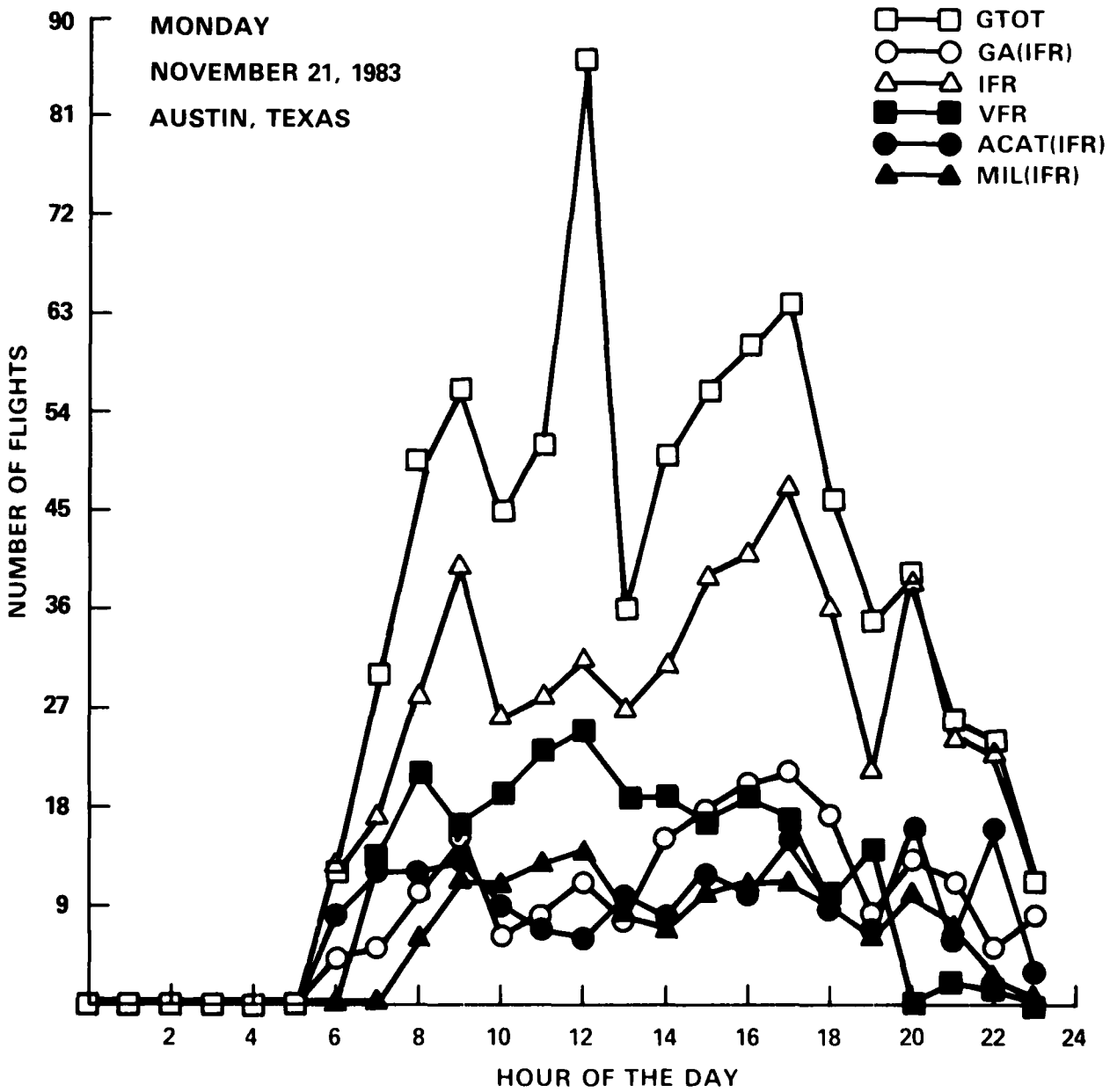

THURSDAY
NOVEMBER 17, 1983
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
80
72
64
56
48
40
32
24
16
8
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY


TUESDAY
NOVEMBER 22, 1983
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
80
72
64
56
48
40
32
24
16
8
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY


FRIDAY
NOVEMBER 18, 1983
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
100
90
80
70
60
50
40
30
20
10
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY


SATURDAY
NOVEMBER 19, 1983
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
60
54
48
42
36
30
24
18
12
6
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY


SUNDAY
NOVEMBER 20, 1983
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
70
63
56
49
42
35
28
21
14
7
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY


MONDAY
NOVEMBER 21, 1983
AUSTIN, TEXAS
GTOT
GA(IFR)
IFR
VFR
ACAT(IFR)
MIL(IFR)
NUMBER OF FLIGHTS
90
81
72
63
54
45
36
27
18
9
2
4
6
8
10
12
14
16
18
20
22
24
HOUR OF THE DAY

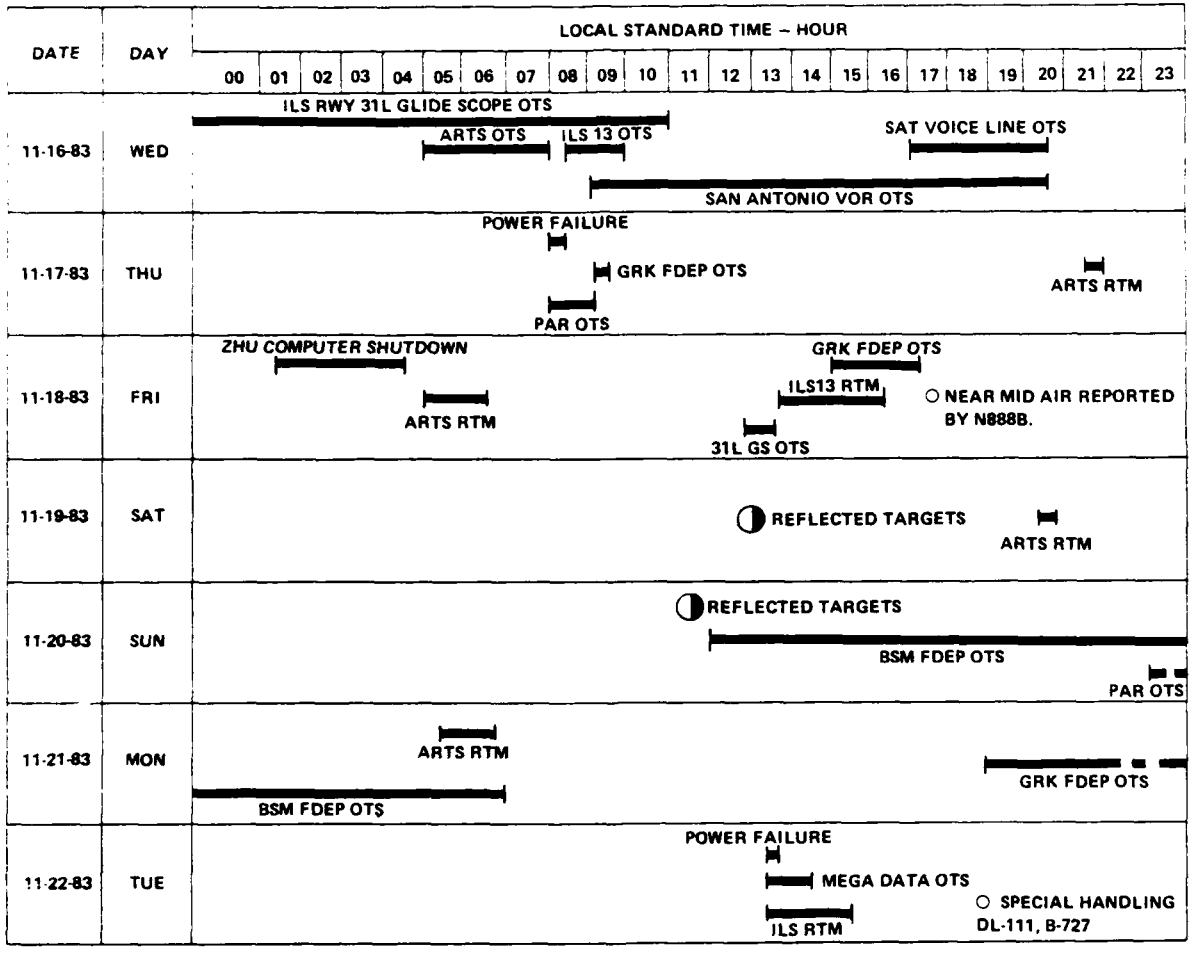
APPENDIX K

FACILITY OPERATIONS RECORD FOR THE TWO LEAD SITES

ROBERT MUELLER MUNICIPAL AIRPORT - AUSTIN, TEXAS

FACILITY OPERATIONS RECORD

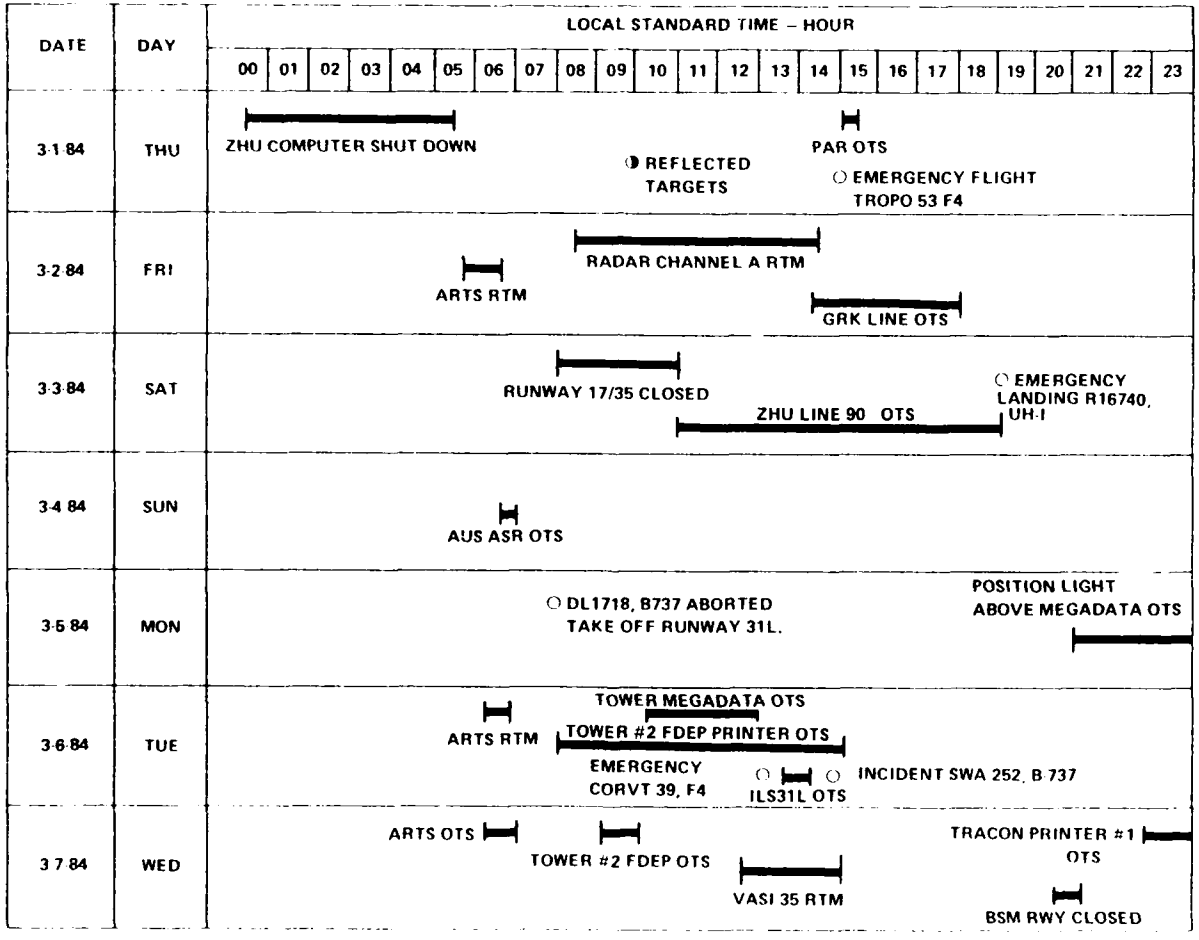
PRE – ARSA



ROBERT MUELLER MUNICIPAL AIRPORT - AUSTIN, TEXAS

FACILITY OPERATIONS RECORD

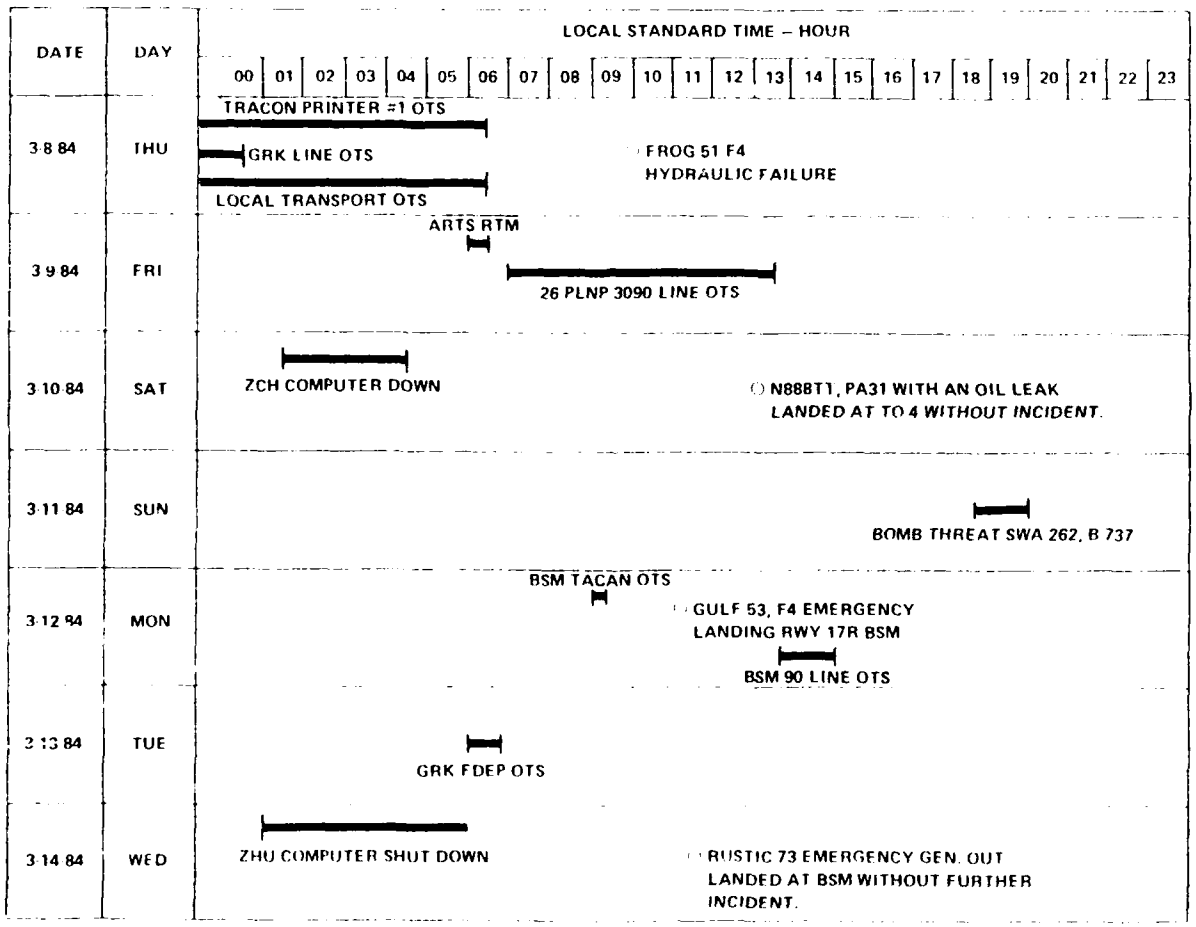
POST – ARSA



ROBERT MUELLER MUNICIPAL AIRPORT - AUSTIN, TEXAS

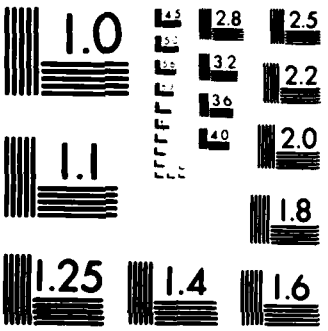
FACILITY OPERATIONS RECORD

POST - ARSA



AD-A150 008 NATIONAL AIRSPACE REVIEW AIRPORT RADAR SERVICE AREA OPERATIONAL CONFIRMAT..(U) ENGINEERING AND ECONOMICS RESEARCH INC VIENNA VA M ROLLS ET AL. OCT 84 3/3

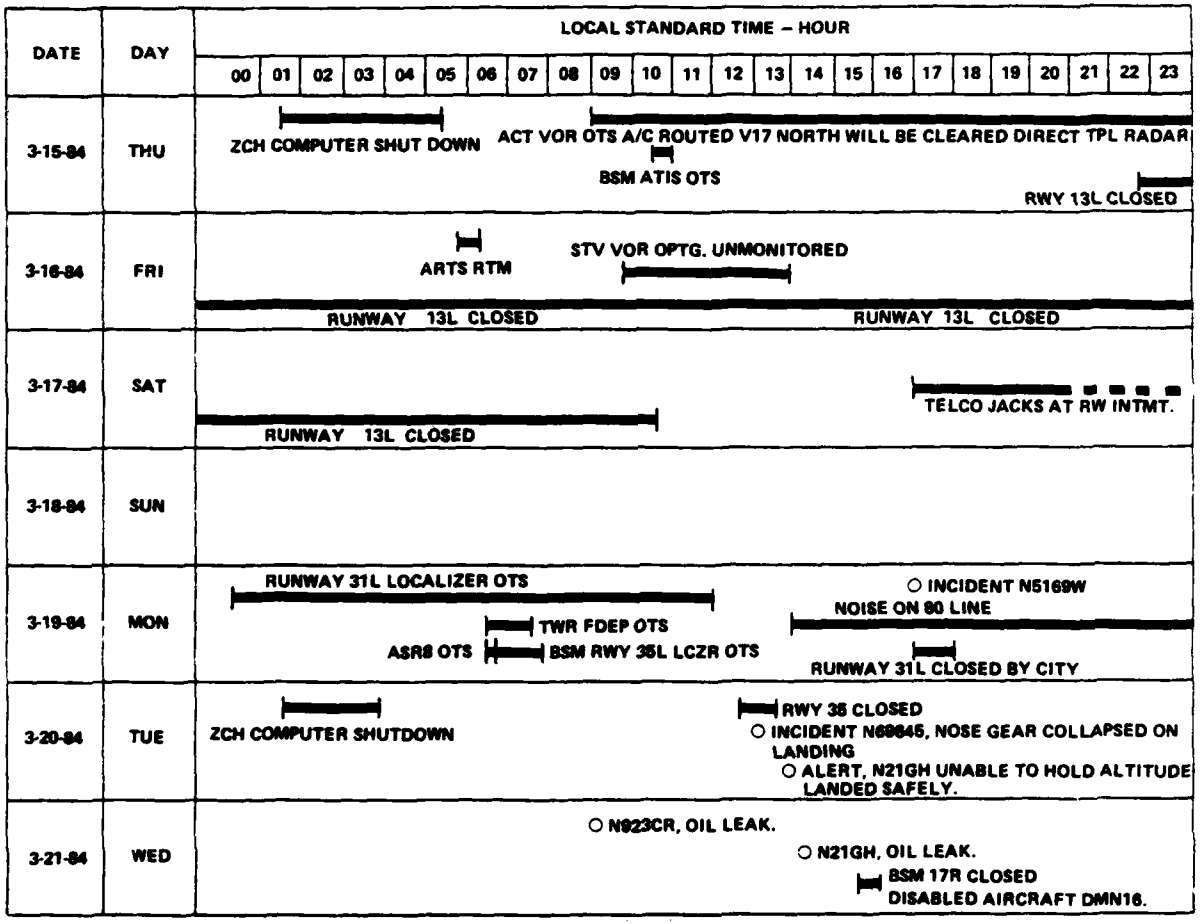
UNCLASSIFIED DOT/FAA/AT-84/2 DTFA01-82-Y-30562 F/G 1/5 NL



ROBERT MUELLER MUNICIPAL AIRPORT - AUSTIN, TEXAS

FACILITY OPERATIONS RECORD

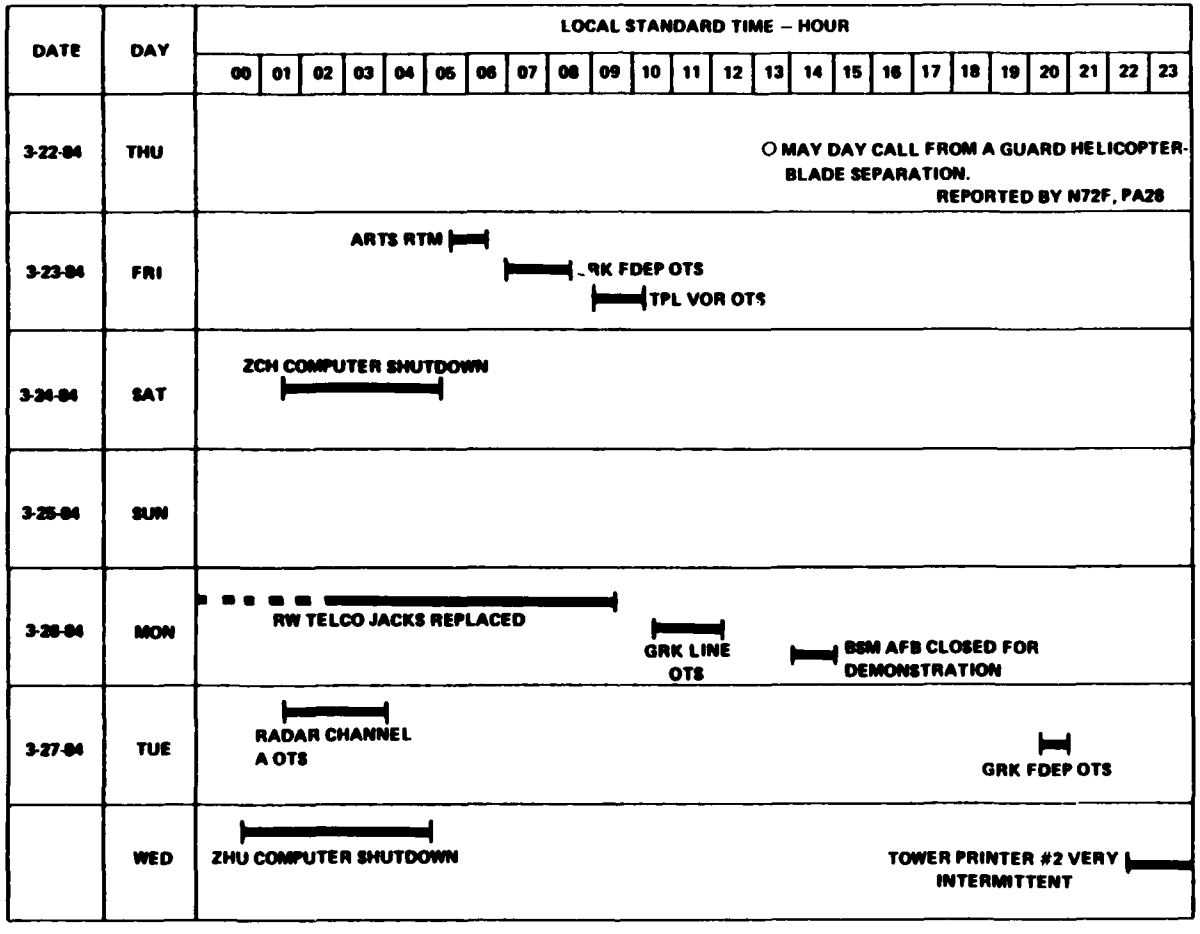
POST – ARSA



ROBERT MUELLER MUNICIPAL AIRPORT - AUSTIN, TEXAS

FACILITY OPERATIONS RECORD

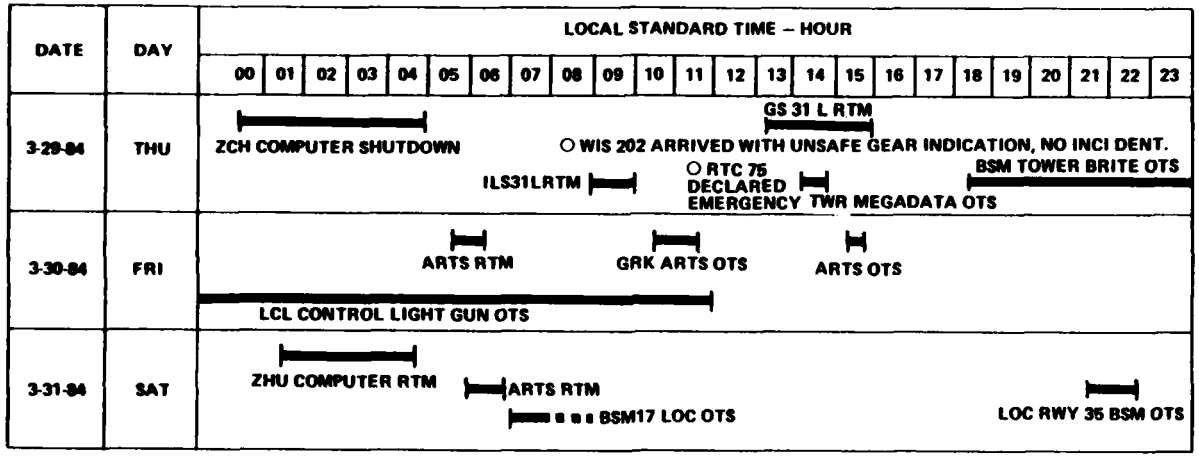
POST – ARSA



ROBERT MUELLER MUNICIPAL AIRPORT - AUSTIN, TEXAS

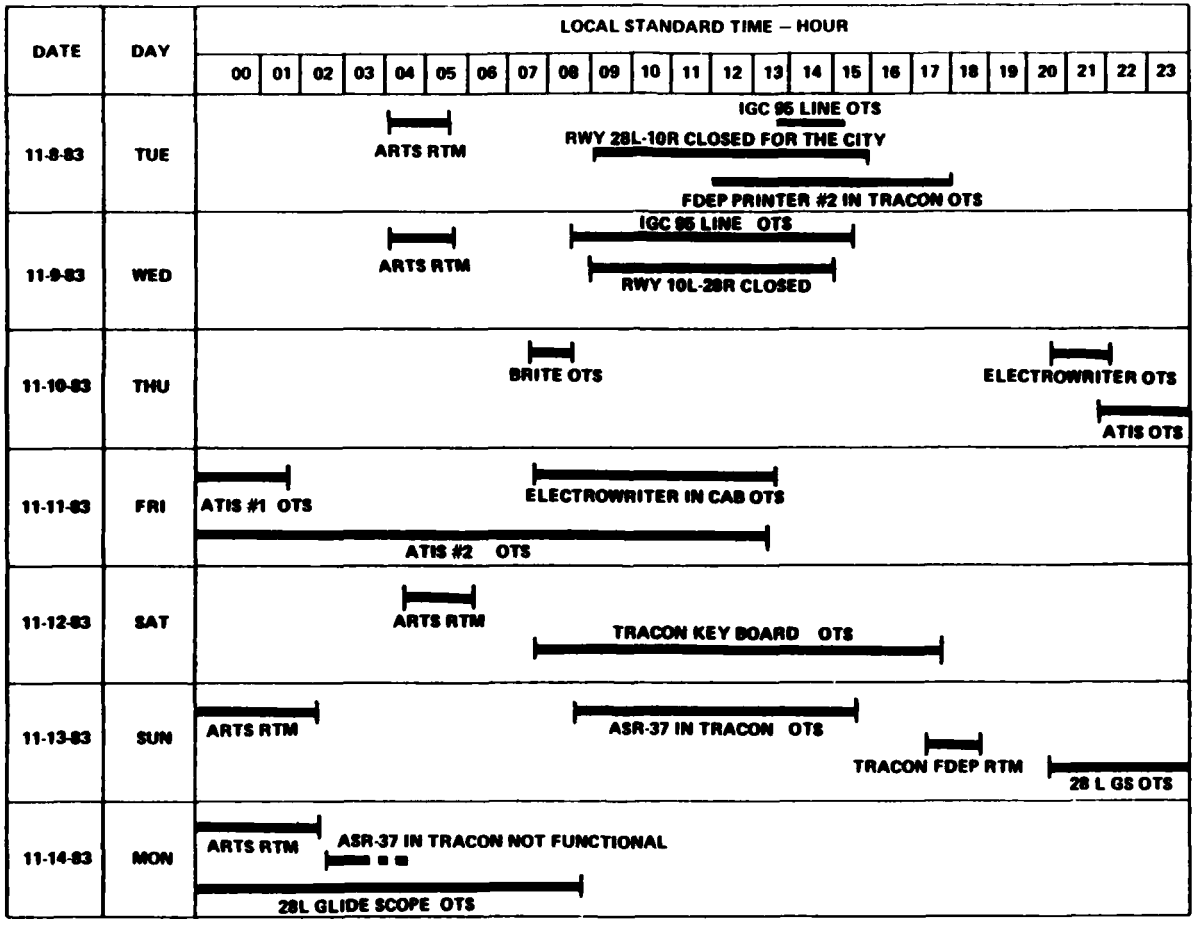
FACILITY OPERATIONS RECORD

POST – ARSA



PORT COLUMBUS INTERNATIONAL AIRPORT - COLUMBUS, OHIO
FACILITY OPERATIONS RECORD

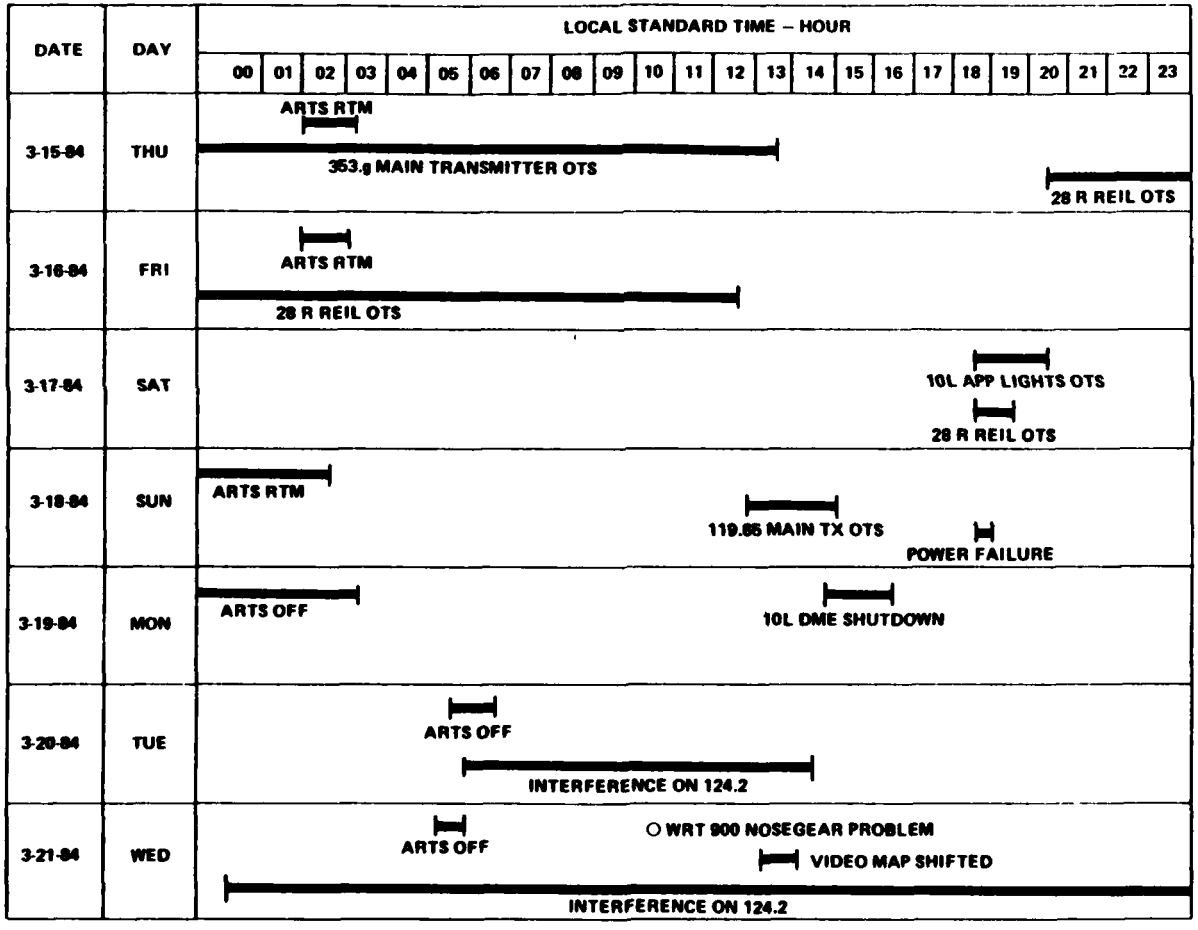
PRE-ARSA



PORT COLUMBUS INTERNATIONAL AIRPORT - COLUMBUS, OHIO

FACILITY OPERATIONS RECORD

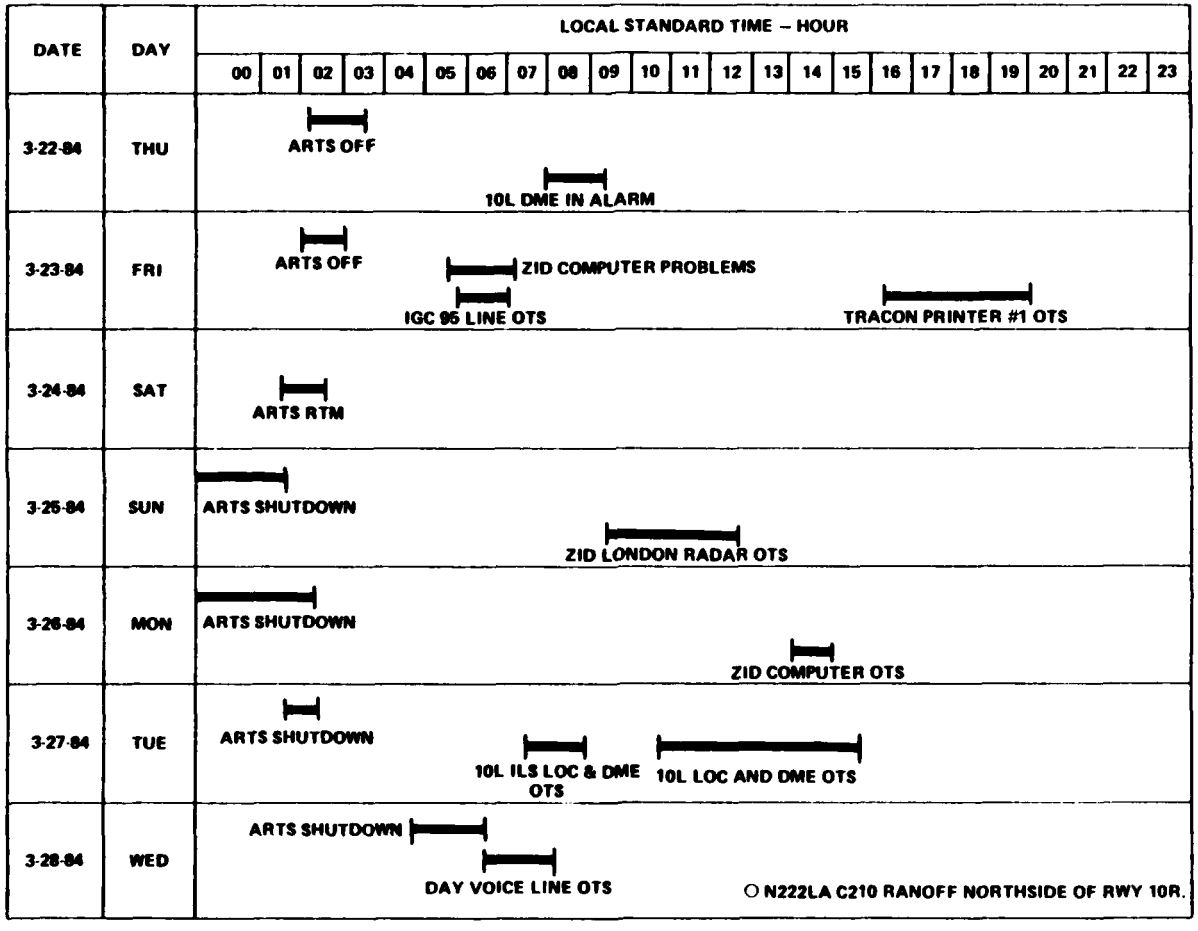
POST – ARSA



PORT COLUMBUS INTERNATIONAL AIRPORT - COLUMBUS, OHIO

FACILITY OPERATIONS RECORD

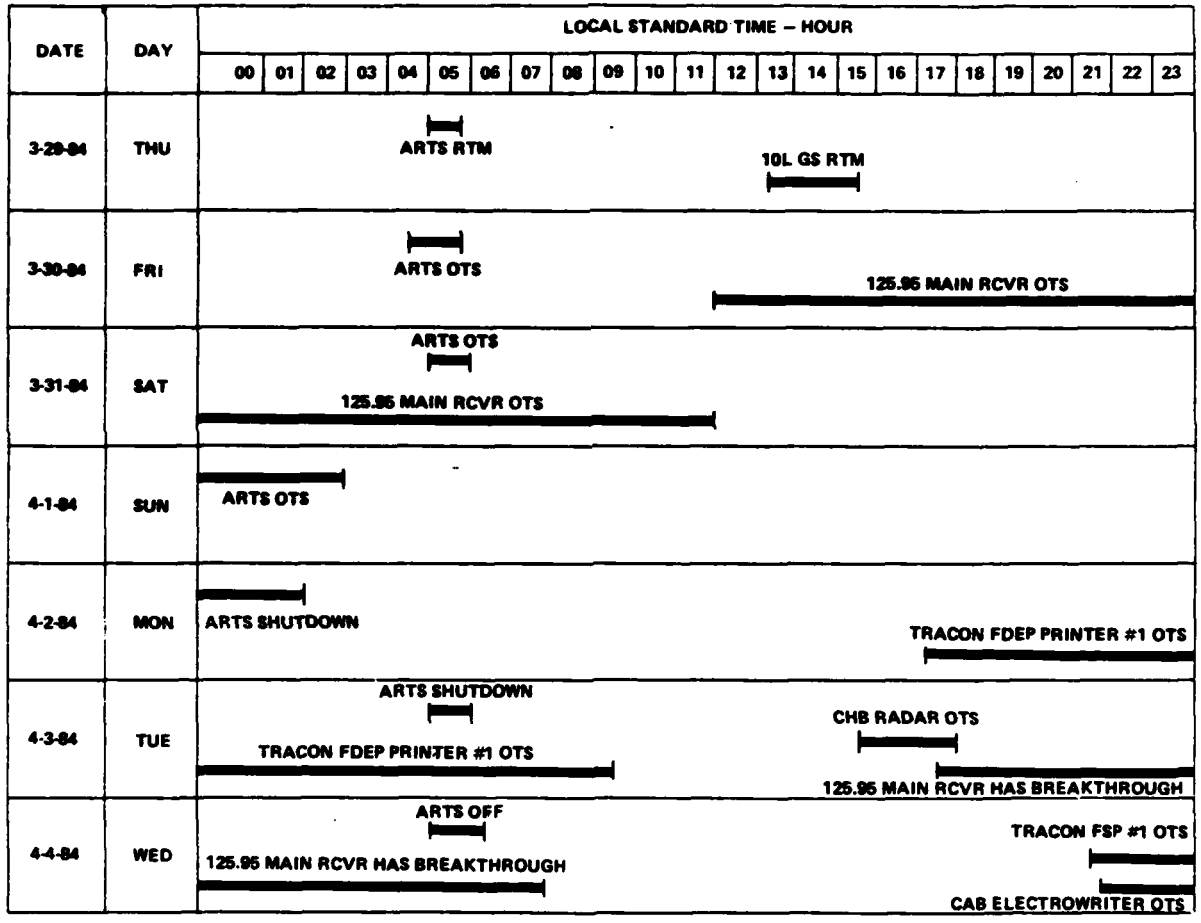
POST – ARSA



PORT COLUMBUS INTERNATIONAL AIRPORT - COLUMBUS, OHIO

FACILITY OPERATIONS RECORD

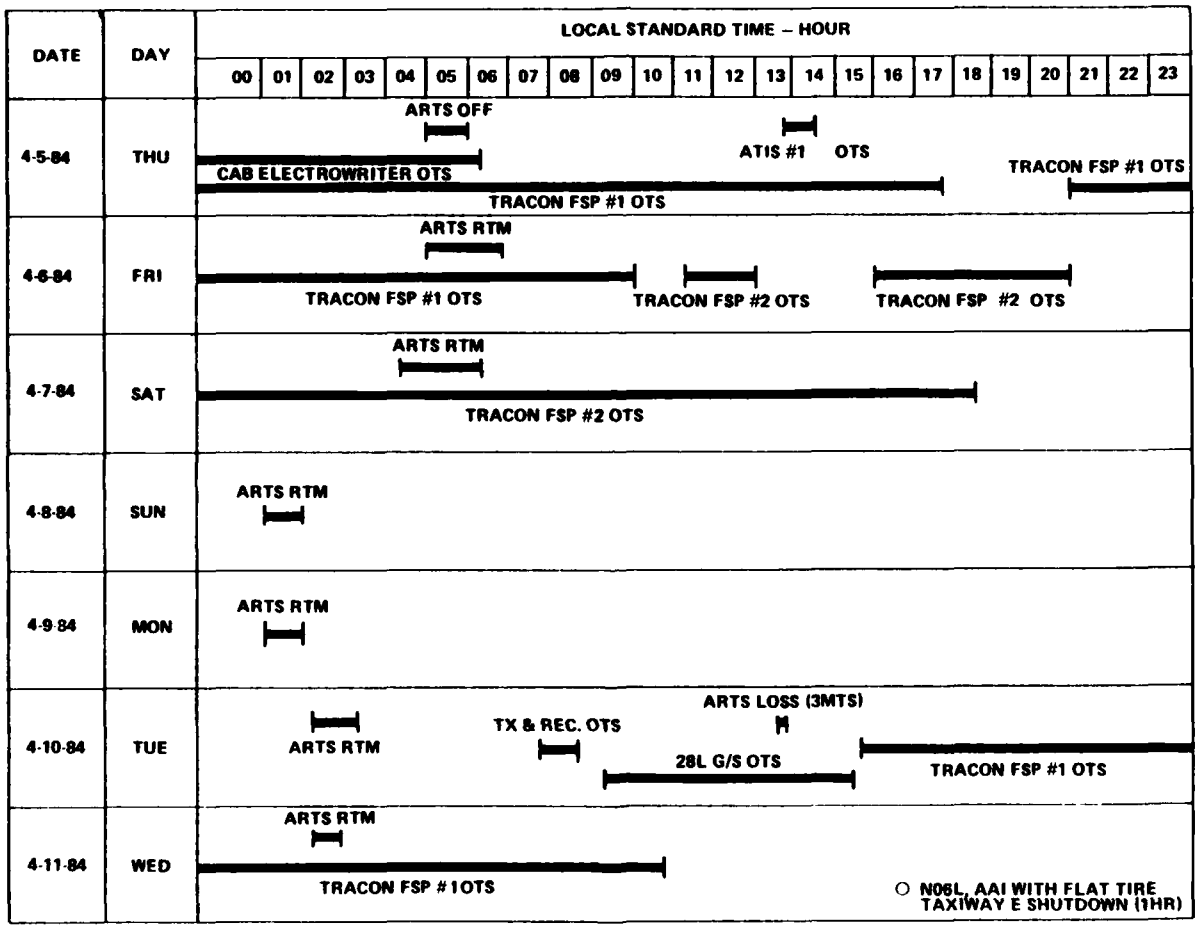
POST – ARSA



PORT COLUMBUS INTERNATIONAL AIRPORT - COLUMBUS, OHIO

FACILITY OPERATIONS RECORD

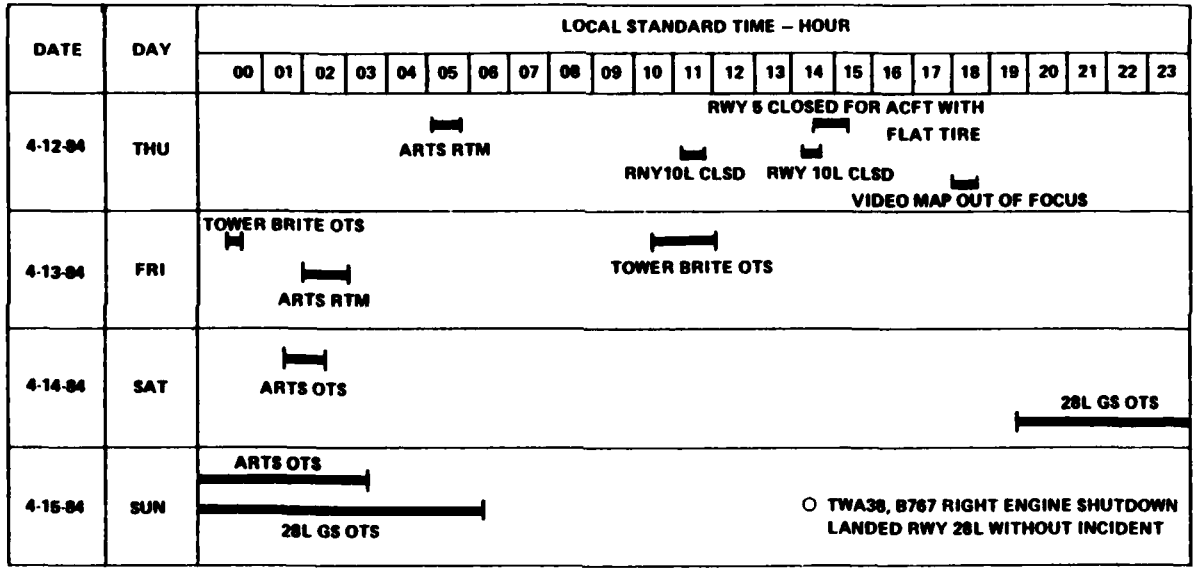
POST – ARSA



PORT COLUMBUS INTERNATIONAL AIRPORT - COLUMBUS, OHIO

FACILITY OPERATIONS RECORD

POST – ARSA



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